

Final

Construction Assessment of the CMSD Landfill Cap Repair

Prepared for

Ormet Primary Aluminum Corporation Hannibal, Ohio

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1. Introduction

On or about 13 June 2006, field maintenance personnel detected a partial failure of the Ormet Primary Aluminum Corporation (Ormet) Construction Materials Scrap Dump (CMSD) landfill multilayer cap on the river (southern) side of the CMSD landfill. ICF International (ICF) inspected the failed areas of the cap on 19 June 2006, and submitted specifications for temporary repairs on 28 June 2006¹. ICF submitted a draft failure analysis report and draft specifications for the permanent repair on 21 November 2006², and delivered a final report and final specifications dated 7 March 2007³ following regulator comments (see Appendix A).

The repair contract was awarded to Kemron Environmental Services (Kemron). Kemron commenced field operations on 4 June 2007 and completed field operations on 27 September 2007. ICF provided technical support and onsite construction oversight during the repair.

This report documents construction compliance with the design, and documents and evaluates any deviations from the design. The report includes the following:

- final construction specifications, including any revisions
- Kemron administrative, material and testing submittals
- field measurements
- construction photographs
- monitoring instrumentation details

2. Construction Specifications

The specifications for repairing the CMSD cap are presented in Appendix B. The scope of work included the following major activities:

- Removal of failed slope material
- Removal of temporary slope protection
- Repair of geomembrane, if needed
- Repair or replacement of geonet and geotextile
- Reconstruction of the vegetative support layer (VSL)
- Construction of slope toe drain
- Construction of midslope drain
- Reconstruction of midslope diversion channels
- Repair of any open cracks in the VSL
- Replacement of rip-rap for riverbank protection
- Seeding

³ ICF International, *Investigation of the CMSD Cap Failure and Specifications for Repair, Monitoring and Maintenance*, Final, 7 March 2007.



¹ ICF International, "Filling Cracks in CMSD Cap" (letter report), 27 June 2006.

² ICF International, *Investigation of the CMSD Cap Failure and Specifications for Repair, Monitoring and Maintenance*, Draft, 21 November 2006.

All work is subject to the inspection, approval, and acceptance of the designated Ormet Technical Representative.

There were two revisions to the specifications during construction. The first revision, promulgated on 6 June 2007, modified the method of payment for the Removal of Failed Slope Material from truck counts to a volume estimate, and affected specification Section 01 22 00 Measurement and Payment, Subpart 1.2.1.2 and Section 31 00 00 Earthwork, Subpart 3.2. The second revision, dated 21 September 2007, specified the installation of an additional perimeter drain outlet pipe in an unfailed section of the slope and affected specification Section 31 00 00, Subpart 3.5.4. Since the contract included unit price line items, the revisions did not require any contract modification, although they did alter the quantities of the line items. The revisions are highlighted in the specifications in Appendix B.

3. Construction Narrative

3.1 Removal of failed slope material

From June 4, 2007 through August 4, 2007, Kemron Environmental Services removed failed slope material, primarily the vegetative support layer (VSL) from the failed slope area on the south side of the CMSD landfill cap. The removal extended horizontally approximately 65-feet east of the vertical downchute discharge drain and approximately 145-feet from the toe of the slope towards the top of the landfill cap. The material was removed from the failed area, including between the slope toe and the Ohio River, and stockpiled just northeast of the landfill cap for screening and reuse. Material was removed with hand tools, a Bobcat T190 mini excavator, and a John Deere 75C track skid steer loader using a 24-inch cleanup bucket. During the removal of failed slope material, geosynthetic materials were inspected by ICF field personnel for ruptures or distress due to excessive strain.

Failed slope material removed from the toe drain area extended horizontally approximately 120-feet east of the vertical downchute discharge drain. Material was removed in order to expose the existing perimeter drain pipes within the toe drain area and to re-grade the area to a 5% slope with material that met the construction specifications outlined in Section 31 00 00 for vegetative support layer (VSL) soil. During removal of the failed material from the toe drain area, landfill material was encountered which included spent carbon anode material, rebar, cement blocks, and bricks. A quantity of less than 100 cubic yards was removed, stockpiled, and covered with plastic sheeting along the northeast side of the landfill cap for subsequent disposition. Removal of the landfill material was necessary due to rebar protrusions which could have damaged the new geomembrane to be installed as part of the toe drain design. The spent anode material was removed offsite by Ormet as a non-hazardous RCRA solid waste.

3.2 Removal of temporary slope protection

Temporary slope protection consisted of plastic sheeting laid out over the entire failed area and toe drain to protect from rain water infiltration and surface water runoff. Plastic sheets were overlapped like shingles from the top of the slope to the toe drain area and were secured with sand bags. The plastic sheets were removed each day in those areas where construction activities were being performed and were replaced each night. Whenever rain was forecast and before



weekends or other periods of inactivity, the plastic sheeting was inspected to ensure everything was secure.

3.3 Repair of geomembrane, if needed

There were no punctures or tears in the geomembrane caused by the cap failure. A few tears or punctures in the geomembrane were caused by construction equipment used in the removal of failed slope material caused by the bucket hitting or scraping the geomembrane. Once the failed slope material was removed, and the exposed areas cleaned, the geosynthetic material was inspected for damages. There were approximately four small tears and four small punctures in the geomembrane in both the toe drain area and the east midslope diversion channel area. Each repair area was marked with a fluorescent lumber crayon and photographed. Geomembrane repairs were performed following the specifications outlined in Section 31 05 19, Subpart 3.3.7 and, only after successful field seam testing, the repairs were accepted by ICF personnel. Prior to any geomembrane being covered by geosynthetic materials, the geomembrane was inspected by ICF field personnel.

3.4 Repair or replacement of geonet and geotextile

As the failed slope material was removed from the slope, four gaps in the existing geotextile and geonet material, running from the top of the failed area towards the toe drain area, required repair. The gaps were between sheets of both geonet and geotextile materials which had been elongated due to the failure. This elongation caused a reduction in the width of the geonet and geotextile and produced gaps between the materials of from 0 to 42-inches running along the slope for 115 to 130 feet. Repairs to the geonet followed the specifications in Section 31 05 19, Subpart 3.2.4.1 and repairs to the geotextile followed the specifications in Section 31 05 19, Subpart 3.2.4.2. Both geonet and geotextile patches were overlapped with the geonet being fastened to the existing geonet with nylon cable ties and the geotextile shingled underneath the existing geotextile. Approximately 1450 square feet of geonet and 760 square feet of geotextile patches were installed within the failed area. Each repaired section of geosynthetic material was inspected by ICF field personnel prior to the placement of any VSL soil.

Geonet and geomembrane material within the bottom 20 feet of the slope were replaced with new geonet and geotextile which were extended across the toe drain as part of the new toe drainage system. The upstream edge of the new geonet material was fastened to the existing geonet using nylon cable ties and the geotextile material was shingled under the existing geotextile.

Geosynthetic materials within the midslope diversion channel were installed following the specification outlined in Section 31 00 00, Part 3.5. All installed geosynthetic materials were inspected by ICF field personnel prior to being covered by other materials.

3.5 Reconstruction of the vegetative support layer

Kemron's work plan called for screening the existing VSL material removed from the failed slope area and reusing it to construct the new vegetative support layer. Since not all of the failed VSL material was recovered, and since the recovered material contained oversized material, vegetation, and stones from the diversion berms, the volume of screened VSL material available for reuse was less than the original VSL volume. Additional VSL material was brought onsite



from the Route 7 Borrow Area and screened to meet specifications. The additional VSL material from the Route 7 Borrow Area also had to pass the laboratory testing specifications outlined in Section 31 00 00, Subpart 2.1 and Section 31 05 19, Subpart 2.4. Reconstruction of the VSL began on August 15, 2007.

Reconstruction of the VSL began by backfilling the failed slope area beginning just above the toe drain and working upward toward the upper diversion berm. Individual lifts were placed and compacted following the specifications outlined in Section 31 00 00, Subparts 3.2.3 through 3.2.4 until the VSL had a thickness of 2 feet. Screened VSL material was transported from the screening area to the failed slope area using a low ground pressure John Deere 250D ADT where material was stockpiled adjacent to the failed area. Lifts were placed starting at the bottom of the slope and pushed upward. ICF personnel inspected to ensure that none of the geosynthetic materials were damaged or altered when the first lifts were being placed. Lifts were spread using a Case 350K WT dozer having a ground pressure of 4.5 psi. The first lifts were compacted with only the weight of the dozer and the second and third lifts were compacted using an Ingersoll Rand SD70 sheepsfoot vibratory compactor. After a lift was compacted and prior to the placement of additional soil, Kemron's geotechnical testing subcontractor performed field moisture content and density testing at several locations within the lift area. ICF field personnel oversaw the field moisture content and density testing, and evaluated the results for compliance with the specifications. There was only one area where initial test results did not meet the density requirements. The lift in this area was reworked and recompacted until the results met specifications. After VSL lifts were completed in a specific area, the area was covered with plastic sheeting and secured with sand bags.

Field density and moisture content testing was not performed immediately after each lift was placed in all areas since the geotechnical subcontractor was not onsite every day. The first and second lifts within the failed area above the toe drain were placed and tested the same day, August 15, 2007. The first lift within the toe drain area was placed on September 14, 2007 after construction of the toe drain drainage system and was field tested on September 18, 2007 with all tests meeting the construction specifications for density and moisture content. Placement of the first lift above the failed upper diversion was not placed until September 15, 2007, after construction of the upper diversion drainage berm, and was field tested on September 18, 2007. Subsequent lifts in both the toe drain and upper failed area were tested on September 21, 2007.

After final grading of all the VSL areas, erosion control blankets were applied to all areas of exposed VSL soil prior to seeding. The erosion control blankets consisted of agricultural straw stitched with degradable thread between two layers of degradable polypropylene netting.

3.6 Construction of slope toe drain

The slope toe drain design was modified on August 9, 2007 due to differences between the original cap design and the actual field geometry. In order to maintain a flat area at the toe of the slope sufficiently wide for vehicular access and to conform the geometry to match the slope profiles adjacent to the section under repair, the revised design increased the width of the slope toe drain and added VSL soil above the drain. After completion of a 5 percent slope along the toe drain area, and exposing the existing geomembrane liner at the toe of the cap slope, a 22-foot wide roll of 40 millimeter thick GSE HD Textured Geomembrane was rolled out lengthwise



across the toe drain area and was welded to the existing geomembrane above the location of the original toe drain perimeter pipe. Geomembrane welding was performed by American Environmental Group based out of Richfield, OH following the specifications outlined in Section 31 05 19, Part 3.3. Destructive field seam strength tests and trial seam testing for shear strength and peel adhesion could not be performed the same day because the tensiometer was not operating properly. The test samples were held and later tested on August 17, 2007 during geomembrane welding for the upper diversion drainage berm. Results for the peel adhesion testing passed on both the trial seam and on the destructive field test with all tests exceeding the 60 psi specification, but results for shear strength in both field and laboratory samples showed shear strengths between 82% and 93% of specification requirements. It was determined by ICF that due to lower tensile strengths exerted on the geomembrane in the vicinity of the weld, that the sheer strength results would be acceptable. The integrity of the toe drain geomembrane seam was also tested with a vacuum box and inspected by ICF field personnel. The geomembrane extends from the bottom of the slope to the riverbank rip rap at an approximate 5% downward slope.

Geonet and geotextile were then placed on top of the geomembrane with the upstream edge of the new geonet material fastened to the existing geonet along the slope, using nylon cable ties. The geotextile material was shingled under the existing geotextile. The toe drain had a width of approximately 15 feet. The geotextile roll had a width of 15 feet and was cut into 34 foot long pieces. Each geotextile piece was laid over the geonet, perpendicular to the slope toe, with the upstream edge shingled under the existing geotextile material along the slope. Each geotextile strip was also overlapped by 36 inches. The geotextile material was extended to the riverbank rip rap with remaining geotextile rolled up while the gravel layer was constructed. A three inch layer of American Association of State Highway and Transportation Officials (AASHTO) M43 Size Number 7 gravel was placed by hand on the geotextile material all along the toe drain from the bottom of the slope towards the riverbank rip rap at a width of approximately 15 feet. Once the gravel was in place, the remaining geotextile material was wrapped over it and shingled under the original geotextile material along the slope. The toe drain area was temporarily covered with plastic sheeting until the first lift of VSL soil was placed.

During removal of the failed VSL soil in the toe drain area, the perimeter drainage piping and geonet was exposed to identify any signs of flow restrictions or nonconformity to original design. Conditions within the gravel surrounding the perimeter drainage piping were wet but no flow restrictions were observed. As part of the toe drain design, the existing perimeter drainage piping at the eastern and western edges of the failed area were to be each connected to a 4 inch diameter HDPE plastic perpendicular outlet pipe. An outlet already existed within a few feet of the perimeter drainage pipe east of the failed area. A perpendicular outlet pipe was added to the perimeter drainage pipe wast of the failed area.

3.7 Construction of midslope drain

The midslope drain above the upper diversion berm was designed to hydraulically isolate the upslope and downslope portions of the geosynthetic drainage layer, direct water from the upslope portion of the geosynthetic drainage layer to the slope surface and midslope diversion channel,



and decrease the quantity of water in the geosynthetic drainage layer in the downslope portion of the slope.

The geosynthetic materials used in the midslope drainage consisted of Agru America Micro Spike HDPE Textured Geomembrane and Agru America Geocomposite 6-200. The geocomposite is a synthetic drainage media where the geotextile is heat-bonded to the geonet. The materials were accepted by ICF with the condition that geotextile used in the geocomposite material be overlain by an additional layer of nonwoven geotextile meeting project specifications. This mitigation was required due to the Apparent Opening Size (AOS) of the geotextile material used in the Agru America Geocomposite 6-200 not meeting the specification.

Removal of VSL soil to construct the midslope drain along the southern slope of the CMSD landfill cap began at the east side of the cap. VSL soil was excavated immediately upslope of the upper diversion berm at a 5% slope for approximately 10 feet until the existing geosynthetic materials were exposed. The geosynthetic material layer was then exposed for an additional 4 feet so that the geotextile and geonet could be cut to separate the upstream and downstream portions. The upside of the excavation was excavated at a 2:1 (horizontal: vertical) slope. The midslope drain excavation extended east of the failed area for a distance of approximately 235 feet and extended west of the failed area a distance of approximately 140 feet. During removal of the VSL soil for the midslope drain, surveyors were brought onsite to mark out the boundaries of the existing TSCA cell on top of the cap to prevent any damage to its liner. Contractors removed a 1 foot wide strip of the existing geotextile and geonet in order to expose the existing geomembrane. The edge of the new geomembrane was extrusion welded onto the surface of the existing geomembrane to create the impermeable base for the new midslope drain.

On August 17, 2007, a roll of AGRU America Micro Spike HDPE geomembrane was rolled out from the east end of the midslope drain excavation to the vertical discharge downchute drain for a distance of approximately 285. The geomembrane was rolled out so that one edge of the geomembrane was contiguous with the exposed existing geomembrane and the edge overlapped the rip rap of the upper diversion berm. The same was done along the west midslope drain for a distance of approximately 130 linear feet into the vertical discharge downchute drain. The geomembrane was welded to the existing membrane by American Environmental Group following the specifications outlined in Section 31 05 19, Part 3.3. Destructive field seam strength tests, trial seam tests for shear strength and peel adhesion, and vacuum box tests along the entire seam were performed, with all tests passing. The geomembrane weld was inspected by ICF field personnel.

Geocomposite material was placed over the geomembrane with the upstream side connected to the existing geonet and the downstream side trimmed adjacent to the upper diversion berm rip rap. On top of the geocomposite material, an additional layer of geotextile material meeting project specifications, was placed and shingled underneath the existing geotextile. The geomembrane material which overlapped the upper diversion berm rip rap was trimmed halfway up the rip rap berm slope. The excavated areas were then backfilled to original grade with screened VSL soil using a mini excavator, leaving approximately 4 feet of geosynthetic material exposed adjacent to the upper diversion berm. The exposed geosynthetic material was covered with a 3 inch layer of AASHTO M43 Size 57 aggregate from the toe of the VSL and extending



up the bottom of the upper diversion berm slope. The original job specifications called for AASHTO M43 Size 6 aggregate but Size 57 was more readily available. ICF determined in the field that the larger Size 57 aggregate would provide more stability during heavy rain events and accepted the substitution.

3.8 Reconstruction of midslope diversion channels

After the final lifts of VSL soil were placed, compacted, and graded within the failed area, the upper and lower midslope diversion channels were rebuilt using rip rap as specified in Section 31 00 00, Subpart 2.2.2. The lower midslope diversion channel is positioned approximately one third of the way up from the toe of the south slope with the upper midslope diversion channel located approximately two thirds of the way up the slope.

Rip rap was transported from a stockpile to the failed area using a mini excavator and placed inline with the existing diversion channel. The rip rap berms in both the upper and lower diversion channels were built having side slopes of 2:1 (horizontal: vertical) and horizontally sloped so precipitation runoff would be diverted to the vertical downchute discharge drain. Approximately 64 linear feet of lower diversion berm was built within the failed area and an additional 50 linear feet was repaired where the existing lower diversion berm was damaged due to construction activities. Approximately 67 linear feet of upper diversion channel was built across the failed area with additional rip rap added to the existing berm in order to secure the geomembrane liner of the midslope drain.

Rip rap for the vertical discharge downchute drainage system was also rebuilt in the upper and lower portions using rock conforming to Ohio DOT Type C. Approximately 150 square yards of rock was placed with an excavator and positioned by hand.

3.9 Repair of any open cracks in the VSL

During and after construction activities for the failed area, ICF field personnel inspected the entire CMSD landfill cap for cracks. There were no remaining cracks observed either in the areas where construction activities had occurred or in vegetated areas not affected by construction activities.

3.10 Replacement of rip-rap for riverbank protection

Riverbank rip rap was replaced after the toe drain VSL was completed to grade and accepted by ICF. Approximately 142 square yards of rip rap conforming to Ohio DOT Type C aggregate was placed along the riverbank for a linear distance of approximately 150 feet. The rip rap riverbank protection was aligned with the existing rip rap and was placed along the river bank using a John Deere 75C track skid steer loader.

3.11 Seeding

Areas where construction activities disturbed the vegetation cover of the site were hydroseeded. Hydroseeding was performed by Greenleaf Landscapes from Marietta, OH on September 27, 2007. A seed rate meeting Ohio DOT specifications for Class 2, of 6 to 8 pounds of seed and fertilizer per 1000 square feet was used in all areas hydroseeded. Prior to hydroseeding erosion control blankets were applied to all exposed VSL soil in sloped areas within the failed area.



An area of approximately 1.5 acres was hydroseeded, including the repaired failure area, the area of the new toe drain, and an area on the top of the cap that Ormet requested be reseeded. Kemron also seeded approximately one acre of areas disturbed by construction activities, including areas of the cap where vegetation was damaged by construction equipment, the Route 7 borrow area, and the soil stockpiling and screening area.

4. Kemron Product, Testing, and As Built Submittals

The construction specifications required Kemron to provide the product data, material testing, and as built submittals listed below. The submittals appear in Appendix C.

SD-03 Product Data

- Geonet
 - Manufacturer's Specifications, geonet, Transnet 200, Engineered Synthetic Products
 - Manufacturer's Specifications, geonet, Transnet 220, Engineered Synthetic Products
 - o Manufacturer's Specifications, geonet, Transnet 220, SKAPS Industries
- Geotextile
 - o Manufacturer's Specifications, geotextile, Mirafi S800, TenCate (fax)
 - o Manufacturer's Specifications, geotextile, Mirafi S800, TenCate (web)
- Geocomposite
 - o Kemron Geomembrane and Geocomposite Material Submittal, 20 August 2007
 - o Manufacturer's Specifications, geonet, 200 mil, Agru America
- Geomembrane
 - o Manufacturer's Specifications, geomembrane, HDPE Micro Spike, Agru America
 - o Manufacturer's Specifications, geomembrane, GSE HDPE textured (fax)
 - o Manufacturer's Specifications, geomembrane, GSE HDPE textured (web)

SD-06 Test Reports

- Vegetative Soil Layer Soil
 - o Kemron Ormet Geotechnical Testing Submittal, 31 Jul 2007
- Borrow Source Assessment
 - o Kemron Borrow Source Certification, 24 Oct 2007 (analytical results only)⁴
- VSL Soil Moisture Content and Density Tests
 - o Kemron Density Testing Results, 22 August 2007
 - o Kemron Density Testing Results, 18 September 2007 and 21 September 2007
- Gravel
 - o Kemron Stone Sieve Analysis, 24 August 2007
- Geomembrane Laboratory Testing

⁴ The concentrations of all tested parameters were below the 2004 EPA Region 9 PRGs for industrial soil, with the exception of arsenic. The concentration of arsenic was within the normally occurring range for Ohio soils. (Ohio Environmental Protection Agency, Division of Hazardous Waste Management, *Closure Plan Review Guidance for RCRA Facilities*, Appendix B, May 2006, p.B-3)



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- o Geomembrane Seam Testing Results, 17 August 2007
- Destructive Field Seam Strength Testing
 - o Kemron Geomembrane Welding Samples, 11 September 2007
- Interface Friction Testing
 - o Kemron Friction Testing Result for the Geonet and Geotextile Materials, 20 August 2007 (geonet vs. geotextile)
 - o Kemron Friction Angle Laboratory Testing Results, 30 August 2007 (VSL vs. geotextile)
 - o Kemron Interface Testing Results, 22 August 2007 (VSL vs. geocomposite)

SD-11 Closeout Submittals

- Kemron As Built Drawing
- Kemron Midslope Diversion Berm, Downchute, and Fence Post Details

ICF reviewed Kemron's material and testing submittals. Written responses regarding geosynthetic properties, aggregate properties, and geomembrane seaming also appear in Appendix C.

5. Design Modifications

The items listed below modified the design relative to the construction specifications included in the final investigation report⁵. For each item, this report describes the deviation, documents the reason for the deviation, and evaluates the impact of the deviation on the performance of the landfill cap. The modified construction specifications appear in Appendix B. Detailed documentation for each modification appears in Appendix D, except where indicated.

5.1 Toe Drain Revision

The design revision was required due to differences between the original cap design and the actual field geometry. The toe of the geomembrane was approximately 8 ft. closer to the river than called for in the design. In order to maintain a flat area at the toe of the slope sufficiently wide for vehicular access and to conform the geometry to match the slope profiles adjacent to the section under repair, the width of the slope toe drain was increased and vegetative support layer (VSL) soil was added above the drain. This modification has no significant impact on the performance of the slope drain, relative to the original design.

5.2 Additional Perimeter Drain Pipe Outlet

The original CMSD landfill cap construction included a 4 inch diameter corrugated plastic perimeter drain pipe along the toe of the slope with several perpendicular outlet pipes. This revision specified the installation of an additional outlet pipe at the east end of the perimeter drain pipe along the south slope of the CMSD landfill cap. This modification provides increased redundancy in releasing water from the perimeter drain pipe, relative to the original design.

⁵ ICF International, *Investigation of the CMSD Cap Failure and Specifications for Repair, Monitoring and Maintenance*, Final, 7 March 2007.



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5.3 Elimination of Perpendicular Drain Pipe Outlet

A field decision was made to eliminate the outlet pipe perpendicular to the perimeter drain pipe at the east edge of the failed area was eliminated. A perpendicular outlet pipe already existed approximately 4 feet east of the limit of excavation in the failed area. The end of the perimeter drain pipe was capped. This modification has no significant on the performance of the slope drain or the ability for water to flow from the perimeter drain pipe, relative to the original design. There is no separate documentation of this modification in Appendix D.

6. Construction Photographs

Over 750 photographs taken prior to and during the repair document the construction activities. The photographs cover the CMSD landfill cap failure, the CMSD landfill cap temporary repair, and the CMSD landfill cap permanent repair. A complete set of photograph thumbnails appears in Appendix E. The accompanying CD contains digital copies of all photographs.

7. Monitoring and Maintenance

Monitoring and maintenance of the CMSD cap are important for its future stability. The following sections present guidelines for the required monitoring and maintenance.

7.1 Inspection

Periodic inspections of the CMSD cap can provide confirmation of proper cap performance and early warning of any malfunctions. Inspections should be performed on foot and look specifically for cracks, erosion damage, animal holes, seepage, subsidence, and any other signs of distress of or changes in the cap. Cracks may be caused by wet-dry or freeze-thaw cycles, or may be an indication of slope instability. Holes may be caused by burrowing animals. Seepage may indicate a problem with the drainage layer. The capping system may exhibit differential settlements that cause ponding of water and increase infiltration.

The inspections should be done following mowing and during other times when visibility permits observing the ground surface, such as in the early spring. The inspection should cover the cap area in sufficient detail to observe linear features less than 10 ft long. The routes used to traverse the cap should vary between inspections to reduce the probability of missing the same areas repeatedly. It is often beneficial to have different inspectors inspect the cap periodically for the same reason. The inspections should be documented on scaled drawings of the CMSD cap, with any identified features located and described in sufficient detail to locate them again and to detect changes.

7.2 Instrumentation

7.2.1 Piezometer Data Loggers

Since the buildup of pore pressures on top of the geonet caused the partial failure of the CMSD cap, three piezometer data loggers⁶ were installed in the lower part of the slope to monitor the

⁶ Model WL16U Data Logger, Global Water Instrumentation, Inc., 11390 Amalgam Way, Gold River CA 95670.



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pore pressures on top of the geonet. If the geonet drain works properly and its discharge rate is higher than the maximum inflow rate from precipitation infiltration, the piezometer data loggers will record zero pore pressures. If the piezometer data loggers record positive pore pressures, it indicates that the geonet drain is not able to discharge all of the inflow water from precipitation infiltration and that additional inspections should be carried out to determine whether there are cracks which have allowed greater inflow from precipitation.

7.2.2 Displacement Monitors

In order to monitor early signs of any downslope movement of the CMSD cap materials, we recommended the placement of three lines of displacement monitors parallel to the slope crest at different heights upon the slope. Each displacement monitor can be a simple wooden stake, 18" to 24" long, driven 12 inches into the VSL. The stakes need to be clearly marked and protected from damage during mowing. Placing a layer of gravel or mulch around the base of the stakes may help limit vegetation growth. The stakes should be placed initially along three straight lines as determined by survey or laser alignment, with a spacing of 50 ft or less between stakes. The first and last stakes should be placed far enough from the repaired zone to be reasonably certain that they are not themselves within a zone of movement. The top of each stake should be permanently marked where the alignment line, defined by two points on the initial and final stakes, crosses the surface of the stake. During subsequent readings by reestablishing the alignment line between the points on the initial and final stakes, the deviation of the intermediate points from the alignment line, if any, will be recorded. Additional details on the proposed layout of the displacement monitors appear in Appendix D.

7.3 Maintenance

Routine maintenance includes the following:

- Vegetation control
- Erosion related maintenance
- Crack related maintenance
- Subsidence related maintenance

Vegetation maintenance includes periodic irrigation and fertilization, as least until vegetation is established, reseeding or replanting areas where vegetation has failed, cutting young trees before their roots disturb the cover system components, and mowing.

Visual inspection of the surface for erosion should be conducted monthly and after major rain storms. It is important that eroded areas be repaired in a timely manner to prevent progressive erosion and damage to the cover system components. It is easier to repair minor erosion rills prior to their expansion into larger erosion gullies.

Crack repair should follow the specifications for the temporary repair. A vigilant inspection program should limit any cracking to small, partially penetrating cracks. The instrumentation should help to determine whether the cracking is caused by widespread instability or by local conditions.



If differential settlement causes ponding, the surface should be recontoured to eliminate the ponding condition. Animals should be removed from their holes and the holes should be backfilled.

7.4 Monitoring and Maintenance Schedule

The monitoring and maintenance schedule is summarized in the table below.

Component	Frequency	Methods			
Inspection	Monthly and after major storms	Visual			
Pore pressures	Monthly and after major storms	Piezometer data loggers			
Displacement	Quarterly	Displacement monitors			
Mowing	Periodically during growing season as necessary to permit visual inspection for cracks.	Power mowers, grass trimmers around instruments			



Appendix A

Ormet Primary Aluminum Corporation

CMSD Landfill Cap Repair

Regulator Comments on Design and Ormet Responses

- Comments, Bernard J. Schorle, USEPA, 21 November 2006
- Response to USEPA comments on "Investigation of the CMSD Cap Failure and Specifications for Repair, Monitoring and Maintenance", 16 January 2007
- Brian H. Queen, SEDO-DSIWM, Geotechnical Resource Group, Ohio EPA, 18 December 2006
- Response to Ohio EPA comments on "Investigation of the CMSD Cap Failure and Specifications for Repair, Monitoring and Maintenance", 7 February 2007
- Brian H. Queen, SEDO-DSIWM, Geotechnical Resource Group, Ohio EPA, 21 February 2007
- Response to USEPA, 11 April 2007



Investigation of the CMSD Cap Failure and

Specifications for Repair, Monitoring and Maintenance

Draft, November 21, 2006

Comments, Bernard J. Schorle, USEPA

1. Introduction.

In the second paragraph (about the field inspection), the term "complete failure" is used. This should have been defined. I expect that it means complete failure of the vegetative support layer, since I do not believe there was failure underneath this. However, one could believe that there was failure down to the wastes, based on the term used.

2. Evaluation of Stability

The reference "Koerner and Daniel (1997)" needs to be added to the list. If the information was actually seen in USEPA (2004), then it is all right to use the USEPA document as the reference.

There probably should be a reference for the laboratory-measured transmissivity of the geonet.

The only COOP precipitation data that I found on the Internet for June 2, 2006 gave me a total amount of rain for the day; it did not give me a figure per hour. If the authors of this report had to somehow calculate the per-hour figure, this needs to be shown or commented on. They also give a maximum hourly rate for the period since 1998; it would be helpful to know what the date for this was. It would also be helpful if they had reported how many times since 1998 there had been a rainfall at a rate greater than that on June 2, 2006.

I follow what they are saying about building up water in the drainage layer due to more water entering than can be handled by it so that this layer becomes full. They are considering the capacity of the drainage layer. However, I also believe that the same thing will happen if the drainage layer is pinched off at the bottom so that it cannot discharge the water that enters it all along the slope, no matter what the capacity of most of the drainage layer is. What was it like at the bottom of the drainage layer where it should have been discharging the water that had entered the drainage layer, both in the failed area and the area adjacent to it? I have not seen anything in the report that describes this.

I question whether monthly mowing is necessary. However, it is necessary that the vegetation be improved from how it has been in some areas.

In section 3.4.1 of the earthwork part of the construction specifications it says, "The original CMSD landfill cap construction included a 4 inch diameter corrugated plastic perimeter drain pipe along the toe of the slope with several perpendicular outlet pipes. The current Project eliminates the perimeter drain pipe in the reconstructed section, but requires the installation of outlet pipes at the ends of the perimeter drain pipe at the sides of the failed section." However, I have not seen in the report that it was verified that this drain pipe was actually installed, either in

the failed area or other areas. Is it there? My concern is that if it is not there, either along the river or along the other sides, are we faced with the threat in the future that there may be other failures because the drainage layer cannot discharge adequately? I believe that this needs to be addressed.

I am assuming that the midslope drain is being constructed in such a manner that water that comes out of the drainage layer there will be adequately carried to one of the downchutes.

January 12, 2007



16 Jan 2007

Mr. John Reggi Ormet Primary Aluminum Corporation State Route 7 Hannibal OH 43931

Re: Response to USEPA comments on "Investigation of the CMSD Cap Failure and Specifications for Repair, Monitoring and Maintenance"

Dear Mr. Reggi,

This memorandum contains ICF's response to comments from Mr. Bernard J. Schorle, USEPA, dated 12 January 2007 regarding ICF draft report "Investigation of the CMSD Cap Failure and Specifications for Repair, Monitoring and Maintenance" dated 21 November 2006.

Each of Mr. Schorle's comments is listed below, followed by ICF's response. We have numbered the comments for reference.

1. Introduction

EPA Comment 1:

In the second paragraph (about the field inspection), the term "complete failure" is used. This should have been defined. I expect that it means complete failure of the vegetative support layer, since I do not believe there was failure underneath this. However, one could believe that there was failure down to the wastes, based on the term used.

ICF Response: Agreed. The phrase "... which suffered complete failure, ..." has been changed to "... which suffered total loss of the VSL, ..."

2. Evaluation of Stability

EPA Comment 2.1:

The reference "Koerner and Daniel (1997)" needs to be added to the list. If the information was actually seen in USEPA (2004), then it is all right to use the USEPA document as the reference.

ICF Response: The reference "Koerner and Daniel (1997)" has been added to the Reference list.

EPA Comment 2.2:

There probably should be a reference for the laboratory-measured transmissivity of the geonet.

ICF Response: The source of the laboratory-measured transmissivity of the geonet "National Seal Company, PolyNet® PN3000 – Production Description, P3-0895" is now added in the text and in the reference list.

EPA Comment 2.3:

The only COOP precipitation data that I found on the Internet for June 2, 2006 gave me a total amount of rain for the day; it did not give me a figure per hour. If the authors of this report had to somehow calculate the per-hour figure, this needs to be shown or commented on. They also give a maximum hourly rate for the period since 1998; it would be helpful to know what the date for this was. It would also be helpful if they had reported how many times since 1998 there had been a rainfall at a rate greater than that on June 2, 2006.

ICF Response: The Record of Climatological Observations Forms from the Climatic Data Center (NCDC) Cooperative (COOP) database contain the daily rain amount and the rain period for each day. The average rainfall intensity is calculated by dividing the daily rain amount by the rain time recorded. It is now clearly stated in the text how the average rain intensity is determined. The number of days when the average rain intensity was greater than

Page 2

the probable precipitation on June 2, 2006 is also included in the text. The text also clarifies that the rain on 2 June 2006 was not an extreme precipitation event. The COOP record for June 2006 is attached to this document.

EPA Comment 2.4:

I follow what they are saying about building up water in the drainage layer due to more water entering than can be handled by it so that this layer becomes full. They are considering the capacity of the drainage layer. However, I also believe that the same thing will happen if the drainage layer is pinched off at the bottom so that it cannot discharge the water that enters it all along the slope, no matter what the capacity of most of the drainage layer is. What was it like at the bottom of the drainage layer where it should have been discharging the water that had entered the drainage layer, both in the failed area and the area adjacent to it? I have not seen anything in the report that describes this.

ICF Response: Due to the displacement of the VSL layer, the pre-failure condition at the toe of the slope is impossible to determine definitively. Inspection of exposed areas of the geotextile and of the underlying geonet showed no areas of distress near the toe. The geonet appeared clean, with little to no evidence of entrapped soil, precipitate deposits, or biological accumulation. The geonet drainage layer is fully covered by designed full thickness of VSL and would not likely be pinched off along the fairly uniform slope. Near the slope toe, the geonet drainage layer should connect to the perimeter drain pipe, although the details of this connection are not documented. During the permanent repair, the perimeter drain pipe will be exposed along the edges of the failure area.

EPA Comment 2.4:

I question whether monthly mowing is necessary. However, it is necessary that the vegetation be improved from how it has been in some areas.

ICF Response: Agree. The frequency of mowing will depend on how fast the vegetation grows. The vegetation should not block visual inspection of the cap surface.

EPA Comment 2.5:

In section 3.4.1 of the earthwork part of the construction specifications it says, "The original CMSD landfill cap construction included a 4 inch diameter corrugated plastic perimeter drain pipe along the toe of the slope with several perpendicular outlet pipes. The current Project eliminates the perimeter drain pipe in the reconstructed section, but requires the installation of outlet pipes at the ends of the perimeter drain pipe at the sides of the failed section." However, I have not seen in the report that it was verified that this drain pipe was actually installed, either in the failed area or other areas. Is it there? My concern is that if it is not there, either along the river or along the other sides, are we faced with the threat in the future that there may be other failures because the drainage layer cannot discharge adequately? I believe that this needs to be addressed.

ICF Response: Field inspection has found the perpendicular drain pipes installed at the site. It is unlikely that the perpendicular drain pipes would have been installed without the perimeter drain pipe. During the permanent repair, the perimeter drain pipe will be exposed along the edges of the failure area.

EPA Comment 2.6:

I am assuming that the midslope drain is being constructed in such a manner that water that comes out of the drainage layer there will be adequately carried to one of the downchutes.

ICF Response: Yes, the water that comes out of the drainage layer from the midslope drain will be adequately carried to one of the downchutes.

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Southeast District Office

2195 Front Street Logan, OH 43138 TELE: (740) 385-8501 FAX: (740) 385-6490 www.epa.state.oh.us

Bob Taft, Governor Bruce Johnson, Lieutenant Governor Joseph P. Koncelik, Director

INTEROFFICE COMMUNICATION

TO:

Michael Sherron, SEDO-DERR

FROM:

Brian H. Queen, SEDO-DSIWM, Geotechnical Resource Group

SUBJECT:

Ormet Primary Aluminum Corporation, Monroe County

2006 Slope Failure Investigation and Repair Document

DATE:

December 18, 2006

On November 22, 2006, the Division of Emergency and Remedial Response (DERR) received an e-mail containing a PDF copy of the DRÁFT "Investigation of the CMSD Cap Failure and Specification for Repair, Monitoring and Maintenance" report, which was prepared by ICF International for Ormet Primary Aluminum Corporation (Ormet). This report outlines the proposed repairs to the area of the capping system that failed on the Construction Materials Scrap Dump (CMSD).

Record Search

The Final Design Report was submitted February 12, 1997. This report required the following cap system in the failure area from bottom to top; a prepared subgrade layer, a Geosynthetic Clay Liner (GCL), a 40 mil textured HDPE liner, a one foot granular drainage Layer, an 8 oz. non-woven geotextile, and a one and half foot vegetative cover seeded with 30% crown vetch, 60% Perennial Ryegrass, and 10% Annual Ryegrass. Waste was to be relocated to form a five acre landfill with a maximum out slope of four horizontal to one vertical (4:1) with a maximum height of thirty-seven feet. The cap drainage layer was to be drained by a four inch perforated corrugated HDPE collection pipe located at the toe of waste and outletted every 200 feet. The river side of the facility was to be excavated back from the 630 elevation fifteen feet. Then the 4:1 waste slope was to be excavated up from there.

The Construction Certification Report was submitted August 12, 1998. This report documented the following cap system components in the failure area; a prepared subgrade layer, a GCL (Bentofix NS), a 40 mil textured HDPE liner (Columbia Geosystems), a geonet drainage Layer (poly-net 3000), an 8 oz. non-woven geotextile, and a two foot vegetative Cover seeded with 30% crown vetch, 60% Perennial Ryegrass, and 10% Annual Ryegrass. Waste was relocated to form a five-acre landfill with a typical out slope of 4:1 with a maximum height of thirty-seven feet. certification did not provide documentation verifying the installation of the four-inch HDPE drainage pipe that was to be located at the toe of the cap drainage layer. The construction as-built drawings indicate that "weep drains" were installed at six locations around the facility. It is not clear, how these drains were constructed or if the geonet was allowed to drain along the toe of the facility.

Monroe County Ormet Primary Aluminum Corporation December 18, 2006 Page 2 of 4

Relevant Quality Control Testing

The interface shear testing between the GCL and HDPE was $\Phi=32^\circ$ a = 19 psf peak and $\Phi=22^\circ$ a = 17 psf residual. The interface shear testing between the geonet and HDPE was $\Phi=18^\circ$ a = 4 psf peak and $\Phi=16^\circ$ a = 1 psf residual. This interface was granted a variance from the originally approved minimum friction angle of 20.5° by U.S. EPA on March 30, 1998. The transmissivity of the geonet and the apparent opening size of the geotextile were not reported. The protective soil was a lean clay with trace rock fragments with a PI below 20 and a minimum tested D₈₅ of 0.29mm.

SUMMARY OF FAILURE

ICF's report states that "On or about 13 June 2006, field maintenance personnel detected a partial failure of the Ormet Primary Aluminum Corporation (Ormet) Construction Materials Scrap Dump (CMSD) landfill multilayer cap on the river (southern) side of the CMSD landfill."

The area of translational¹ slope failure was less than an acre in extent on the riverside of the landfill. Most of the failure appears to have moved less than two feet. At the crest of the slope, the HDPE liner was exposed and the geonet appears to have moved translationally to it. However, in one discreet area the protective cover has moved translationally on top of the geotextile and has left the geotextile completely exposed. This area is approximately thirty feet wide and extends nearly to the top of the slope. The geonet in this area does not appear to be clogged with roots or fines, and the failure mass at the base of the slope did not appear to contain remnants of the 4-inch HDPE cap drainage pipe.

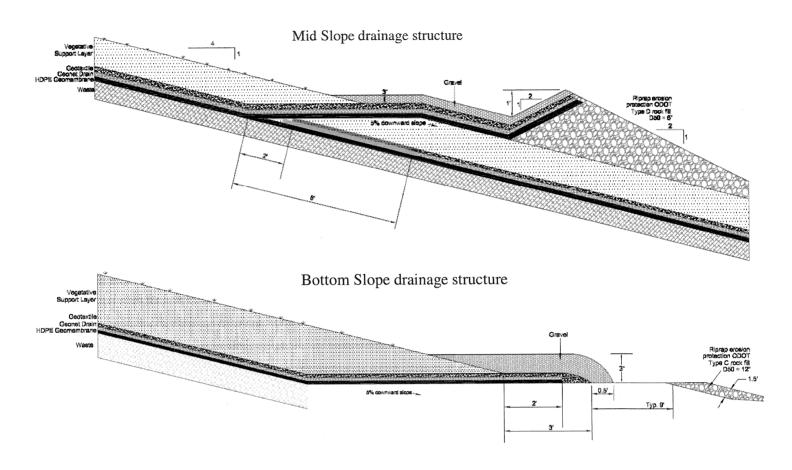
Comments on the DRAFT Investigation of the CMSD Cap Failure and Specification for Repair, Monitoring and Maintenance report

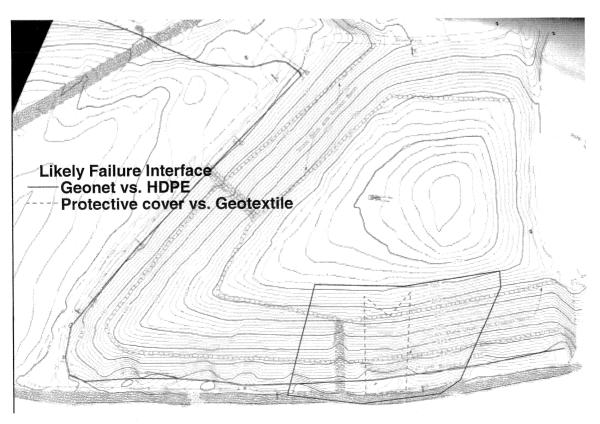
1. This report discuses the likely causes of failure as a buildup of pore water pressure in the cap drainage layer and vegetative layer. This buildup was most likely caused by excessive infiltration through cracks in the vegetative layer and insufficient drainage being provided to the geonet drainage layer. This report appears to require the installation of a mid-slope and bottom-slope drainage structure for the repaired cap drainage layer only in the area where the geonet has been completely exposed by the failure. This would leave the rest of the failed slope without proper drainage. Ohio EPA recommends installing the mid-slope and bottom-slope drainage structure along the entire riverside slope area particularly in the areas where movement has occurred.

On the following page, we have included ICF's detail drawings of their proposed midslope and bottom-slope drainage structures and the location of the observed failure.

¹ Translational failures occur along a planar failure surface that parallels a weak layer or interface and exits through the overlying stronger material.

Monroe County Ormet Primary Aluminum Corporation December 18, 2006 Page 3 of 4





Monroe County Ormet Primary Aluminum Corporation December 18, 2006 Page 4 of 4

2. Construction Specification - Section 31 05 19 "Geosynthetics for Earthwork" subsection 2.4 "Interface Frictions Testing" only requires the laboratory interface for the Geosynthetic drainage layer vs. Geotextile and the Geotextile vs. Vegetative Soil Layer. However, the largest portion of the failure occurred between the Geomembrane and the Geosynthetic drainage layer. We would recommend including this interface in the testing protocol. It should be noted that when this interface was tested in 1996 it had a friction angle 18° and an adhesion of 4 psf peak, which does not meet the requirements specified in sections 2.4.1 and 2.4.2. However, replacing the geonet and the geotextile with a geocomposite drainage layer (a geonet with a geotextile heat bonded to both sides of the geonet) will typically result in friction angles that can meet these specifications. This replacement is currently listed as an option in the specifications.

Recommendations

Ohio EPA recommends doing the following:

1. Remove the temporary protection, the existing geonet and geotextile, and the vegetative layer that has slid completely off the slope.

2. Install the geocomposite drainage layer instead of a geonet/ geotextile drainage layer

and cover with appropriate vegetative layer.

3. Install mid-slope drainage structure in the areas where any down slope movement has occurred.

- 4. Replace the surface water down chute and direct the mid-slope drains into the down chute.
- 5. Install the Bottom-slope drainage structure along the entire riverside of the facility.
- 6. Reseed as necessary.



7 Feb 2007

Mr. John Reggi Ormet Primary Aluminum Corporation State Route 7 Hannibal OH 43931

Re: Response to OhioEPA comments on "Investigation of the CMSD Cap Failure and Specifications for Repair, Monitoring and Maintenance"

Dear Mr. Reggi,

This memorandum contains ICF's response to comments from Mr. Brian H. Queen, Ohio EPA, dated 18 December 2006 regarding ICF draft report "Investigation of the CMSD Cap Failure and Specifications for Repair, Monitoring and Maintenance" dated 21 November 2006.

Each of the Ohio EPA's comments is listed below, followed by ICF's response. We have maintained the Ohio EPA's general numbering of the comments for reference, with letters to distinguish separate responses to issues within a single numbered comment. For example, 1a and 1b pertain to separate parts of Mr. Queen's comment 1.

Ohio EPA Summary of Failure (SFa): The area of translational slope failure was less than an acre in extent on the riverside of the landfill. Most of the failure appears to have moved less than two feet. At the crest of the slope, the HDPE liner was exposed and the geonet appears to have moved translationally to it.

ICF Response: We generally concur with the Ohio EPA's description of the failure, but note that in the area of limited translation, the failure occurred along two interfaces, i.e. between the geotextile and geomet and between the geonet and geomembrane. The photos on the next page show the exposed geonet and geomembrane due to the movement along these two interfaces.

Ohio EPA Summary of Failure (SFb): ... the failure mass at the base of the slope did not appear to contain remnants of the 4-inch HDPE cap drainage pipe.

ICF Response: We concur that the perimeter drain pipe was not apparent in the failure mass. We suspect that the pipe remains buried within the failed soil mass. Field inspection outside of area which suffered total loss of the VSL has found the perpendicular drain pipes installed at the site. It is unlikely that the perpendicular drain pipes would have been installed without the perimeter drain pipe. During the permanent repair, the perimeter drain pipe should be discovered within the failure mass and the remaining perimeter drain pipe should be exposed along the edges of the area which suffered total loss of the VSL. If the perimeter drain pipe has not been installed, the geonet will be extended beyond the toe as shown in Figure 2, Inset 3 of the specifications along the entire slope to provide a drainage outlet.



Photo 1: Exposed geonet due to slide along geotextile and geonet interface



Photo 2: Exposed geomembrane due to slide along geonet and geomembrane interface

Page 3

Ohio EPA Comment 1a: This report appears to require the installation of a mid-slope and bottom-slope drainage structure for the repaired cap drainage layer only in the area where the geonet has been completely exposed by the failure. This would leave the rest of the failed slope without proper drainage. Ohio EPA recommends installing the mid-slope and bottom-slope drainage structure along the entire riverside slope area particularly in the areas where movement has occurred.

ICF Response: The repair design includes installation of the mid-slope drainage structure along the entire riverside slope. Within the area which suffered total loss of the VSL, the upper and lower diversion berms will be reconstructed, and the upper diversion channel will incorporate the midslope drainage structure. Outside the area which suffered total loss of the VSL, the midslope drainage structure will be constructed just above the existing upper diversion berm.

The repair design calls for the construction of the bottom slope drainage structure only in the failed area. Our current understanding is that the remainder of the slope has a perimeter drainage pipe connected to the geonet. The perpendicular outlet pipes that connect to the perimeter drainage pipe have been located in the field. We will verify the existence of the perimeter drain pipe and the details of its connection to the geonet during the repair. If the perimeter drain pipe is not found during the repair, the bottom-slope drainage structure will be installed not only in the failed area but also in the unfailed area. The midslope drainage structure will reduce the amount of flow which reaches the perimeter drainage pipe. We considered the potential improvement in slope toe drainage from extending the bottom slope drainage structure along the entire riverside toe, but balancing the risk of damage to the geomembrane from excavating along the toe with the nine year history of cap stability and the reduced flow to the toe, we chose maintaining the existing drainage system as the preferred alternative in the unfailed areas.

Ohio EPA Comment 2a: Construction Specification - Section 31 05 19 "Geosynthetics for Earthwork" subsection 2.4 "Interface Friction Testing" only requires the laboratory interface for the Geosynthetic drainage layer vs. Geotextile and the Geotextile vs. Vegetative Soil Layer. However, the largest portion of the failure occurred between the Geomembrane and the Geosynthetic drainage layer. We would recommend including this interface in the testing protocol.

ICF Response: The repair specifications do not call for the replacement of the geonet over significant areas of the slope. The existing geonet is generally intact and undamaged, but may require minor repairs or patching along the boundaries of the main failure area. Because of this small area, because of the existence of interface friction data from 1997, and because samples of the original geomembrane are not readily available for testing without cutting and repairing the existing geomembrane, we did not require testing for the geomembrane and geonet interface. We agree that if the geonet is removed and replaced over large areas, either with a different geonet or a geocomposite drain, then the interface friction angle for the new interface should be determined.

Ohio EPA Comment 2b: It should be noted that when this interface [geomembrane vs. geonet] was tested in 1996 it had a friction angle 18" and an adhesion of 4 psf peak, which does not meet the requirements specified in sections 2.4.1 and 2.4.2. However, replacing the geonet and the geotextile with a geocomposite drainage layer (a geonet with a geotextile heat bonded to both sides of the geonet) will typically result in friction angles that can meet these specifications. This replacement is currently listed as an option in the specifications.

ICF Response: Using a geocomposite drainage layer would increase the shear resistance along the geonet and geomembrane interface but would create a new geotextile-geomembrane interface. Based on test data from a limited literature review (see Table 1), the shear strength along the geotextile-geomembrane interface may not be significantly greater than that between the original geonet and geomembrane

Page 4

interface. Any geosynthetic placed over the geomembrane, either a geonet or a geocomposite drain, and used over a large area should be tested to determine the geosynthetic-geomembrane interface friction properties of the specific materials used. The current design does not propose replacement of the geonet in the failed slope area. Replacement of the geonet with a geocomposite drain in the failed area would not increase the stability of the majority of the slope outside of the failed area.

Table 1: Summary of interface parameters

		Pe	ak	Resi	dual	
Material 1	Material 2	c (psf)	φ (deg)	c (psf)	φ (deg)	Remark
CMSD Geonet	CMSD Geomembrane	4.0	18.0	1.0	16.0	NSC(1997)
Geotextile, NW, NP	Textured HDPE		14.1			Jain & Mandal
			(dry)			(2005)
Geotextile, NW, NP	Textured HDPE		18.4			Jain & Mandal
			(wet)			(2005)
Geotextile, NW, HB	Textured HDPE		11.3			Jain & Mandal
			(dry)			(2005)
Geotextile, NW	Textured HDPE		33			JUTA (2001)
Geotextile, NW, NP	Textured HDPE		15			Kim (2006)
Geotextile, NW, HB	Textured HDPE		16			Kim (2006)

NOTES: NW = Nonwoven, NP = Needle-punched, HB = Heat-bounded References:

- Jain, A. & Mandal, J. N. (2005). "Computer Aided Design and Analysis of Geosynthetic Landfills." Proceedings of the Twentieth International Conference on Solid Waste Technology and Management, 3-6 April 2005, Philadelphia, PA.
- JUTA (2001). "Technological Standard, Junifol HDPE Landfills." From www.juta.cz/english/Netex_manual.pdf.
- Kim, D. (2006). "Multi-scale assessment of geotextile-geomembrane interaction." PhD thesis, Georgia Institute of Technology.
- National Seal Company (1997), "Direct Shear Friction Tests, Ormet Landfill", 2 Oct 1997.

Recommendations

Ohio EPA Recommendation (R1): Remove the temporary protection, the existing geonet and geotextile, and the vegetative layer that has slid completely off the slope.

ICF Response: The existing geonet and geotextile within the area which suffered total loss of the VSL are generally intact and undamaged. Removing the geonet and geotextile would disrupt the continuity of the geosynthetics. The repair design specifies repair or replacement of locally damaged areas only.

Ohio EPA Recommendation (R2): Install the geocomposite drainage layer instead of a geonet/geotextile drainage layer and cover with appropriate vegetative layer.

ICF Response: Replacement of the geonet/geotextile drainage layer with a geocomposite drain would not likely produce a significant increase in the slope stability and may induce other complications. The stability of the repaired area using the existing geonet and geotextile will be similar to the stability of the remainder of the CMSD cap.

Ohio EPA Recommendation (R3): Install mid-slope drainage structure in the areas where any down slope movement has occurred.

ICF Response: The repair design calls for construction of the midslope drainage structure along the entire length of the river side of the CMSD landfill cap.

Ohio EPA Recommendation (R4): Replace the surface water down chute and direct the mid-slope drains into the down chute.

ICF Response: Any damage to the surface water downchute will be repaired. The repair design calls for restoring the connection between the midslope drainage channels and the downchute.

Ohio EPA Recommendation (R5): Install the Bottom-slope drainage structure along the entire riverside of the facility.

ICF Response: The midslope drainage structure will reduce the amount of flow which reaches the perimeter drainage pipe. We considered the potential improvement in slope toe drainage from extending the bottom slope drainage structure along the entire riverside toe, but balancing the risk of damage to the geomembrane from excavating along the toe with the nine year history of cap stability and the reduced flow to the toe, we chose maintaining the existing drainage system as the preferred alternative in the unfailed areas.

Ohio EPA Recommendation (R6): Reseed as necessary.

ICF Response: The project specifications require inspection of all seeded areas between 6 and 12 months after final seeding, and reseeding by the contractor in any areas without established vegetation. Beyond this time, cap maintenance will be the responsibility of Ormet.

Southeast District Office

2195 Front Street Logan, Ohio 43138 TELE: (740) 385-8501 FAX: (740) 385-6490 www.epa.state.oh.us

Ted Strickland, Governor Lee Fisher, Lieutenant Governor Chris Korleski, Director

INTEROFFICE COMMUNICATION

TO:

Michael Sherron, SEDO-DERR

FROM:

Brian H. Queen, SEDO-DSIWM, Geotechnical Resource Group

SUBJECT:

Ormet Primary Aluminum Corporation, Monroe County

2006 Slope Failure Investigation and Repair Document

February 7, 2007 response letter.

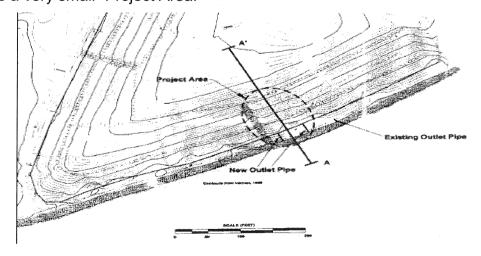
DATE:

February 21, 2007

On February 8, 2007, the Division of Emergency and Remedial Response (DERR) received an e-mail containing a PDF copy of a response letter to my IOC on the DRAFT "Investigation of the CMSD Cap Failure and Specification for Repair, Monitoring and Maintenance" report, which was prepared by ICF International (ICF) for Ormet Primary Aluminum Corporation (Ormet). ICF Internationals responses to my comments were mostly reasonable however they should incorporate there responses into the final report.

Specifically ICF should do the following.

- Incorporate an investigation of the toe of the riverside of the facility to determine if the cap drainage pipe exists. If the pipe does not exist the report should clearly state that the bottom-slope drainage structure will be installed around the entire toe of the facility. If the pipe does exist, the report should be revised to include the installation of permanent clean out access ports at appropriate intervals around the facility. Then the pipe should be cleaned out and a regular cleanout schedule should be established.
- 2. Figure 1 should be revised to clearly show that the mid-slope drainage structure would be installed across the entire riverside of the facility. Figure one currently only shows a very small "Project Area."





April 11, 2007

Mr. Bernie Schorle Remedial Project Manager SR-6J USEPA Region V 77 West Jackson Blvd. Chicago, IL 60604-3590

Dear Mr. Schorle:

In response to the OEPA comments regarding the cap toe drain repair or replacement in the final cap repair document, Ormet is confirming that the toe drain will be inspected and, if necessary, repaired or replaced. If the perimeter toe drain does not exist, Ormet will install the new toe drain along the entire slope. The installation of cleanout ports in the toe drain perimeter pipe will be added as requested.

The conditions of the existing geonet and perimeter drain pipe will be inspected to identify any signs of flow restrictions. If the existing drainage system does not conform to our current understanding, or if the investigations suggest potential malfunction of the system, additional exploration pits will be dug along the toe to expose additional parts of the drainage system. If the perimeter drain pipe does not exist or if there is evidence of system malfunction, the toe drain shown in Figure 13 will also be installed in the unfailed area. If the perimeter toe drain pipe is clogged with roots, Ormet would consider that to be a malfunction of the system and propose appropriate modifications, up to and including installing the new slope toe drain detail along the entire toe. Ormet will document the "As built" details of the toe drainage system in the construction report.

Please let me know if there are questions.

Respectfully,

John Reggi, Director Corporate Env. Services

cc: Tommy Temple

Ralph Grismala, P. E.

Michael Sherron

Ormet Corporation

ICF International

OEPA SEDO

Appendix B Ormet Primary Aluminum Corporation CMSD Landfill Cap Repair Construction Specifications



PROJECT TABLE OF CONTENTS

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00 41 00 BID SCHEDULES

unit prices, additive and deductive bid items, and options

DIVISION 01 - GENERAL REQUIREMENTS

01 11 00	SUMMARY OF WORK Basic Project description and special administrative instructions.
01 22 00	MEASUREMENT AND PAYMENT Lump Sum payment items. Unit Price payment items, measurements, and units of measure.

01 33 00 SUBMITTAL PROCEDURES

General descriptions of Project submittals.

01 35 23 OWNER SAFETY REQUIREMENTS
Mandatory Project safety requirements.

01 45 00 CONSTRUCTION QUALITY CONTROL

Consolidated list and cross references to Project

submittals required within individual technical sections,

including submission deadlines and procedures.

DIVISION 02 - Not Used

DIVISION 03 - Not Used

DIVISION 04 - Not Used

DIVISION 05 - Not Used

DIVISION 06 - Not Used

DIVISION 07 - Not Used

DIVISION 08 - Not Used

DIVISION 09 - Not Used

DIVISION 10 - Not Used

DIVISION 11 - Not Used

DIVISION 12 - Not Used

DIVISION 13 - Not Used

DIVISION 14 - Not Used

DIVISION 21 - Not Used

DIVISION 22 - Not Used

DIVISION 23 - Not Used

DIVISION 25 - Not Used

DIVISION 26 - Not Used

DIVISION 27 - Not Used

DIVISION 28 - Not Used

DIVISION 31 - EARTHWORK

31 00 00	EARTHWORK Earthwork features and activities including removal of failed slope material, Vegetative Support Layer reconstruction, geonet, geotextile, riverbank rip-rap, midslope diversion channels, and slope toe drain
31 05 19	GEOSYNTHETICS FOR EARTHWORK Requirements for geotextiles, geonets, and geomembranes.
31 10 00	CLEARING FOR CIVIL WORKS Clearing and disposal of trees and brush, temporary removal of fences, and disposal of debris, trash, and materials resulting from clearing operations.
31 25 13	EROSION AND SEDIMENTATION CONTROLS soil surface erosion control. This specification does

not include sediment and pollution control measures

DIVISION 32 - EXTERIOR IMPROVEMENTS

32 00 00 EXTERIOR IMPROVEMENTS
Requirements for seeding and site restoration

DIVISION 33 - Not Used

DIVISION 34 - Not Used

DIVISION 35 - Not Used

DIVISION 40 - Not Used

DIVISION 41 - Not Used

DIVISION 42 - Not Used

DIVISION 43 - Not Used

DIVISION 44 - Not Used

DIVISION 45 - Not Used

DIVISION 48 - Not Used

-- End of Project Table of Contents --

DOCUMENT 00 41 00

BID SCHEDULES 04/06

PART 1 GENERAL

1.1 BASIS OF BIDS

Estimated quantities presented below are for bidding purposes only. Payments for unit priced items will be based on actual, approved quantities installed in accordance with the drawings and specifications and accepted by the Owner's Technical Representative.

Item	Description	Estimated Quantity	Unit	Unit Price	Extended Amount
1.1.1	Mobilization and Site Preparation	1 Job	LS	N/A	\$
1.1.2	Removal of Temporary Slope Protection	1 Job	LS	N/A	\$
1.1.3	Site Restoration and Demobilization	1 Job	LS	N/A	\$
1.2.1	Removal of Failed Slope Material	2000	CY	\$	\$
1.2.2	Geomembrane	1200	SY	\$	\$
1.2.3	Geosynthetic Drainage Layer	500	SY	\$	\$
1.2.4	Geotextile	500	SY	\$	\$
1.2.5	Vegetative Support Layer	1700	CY	\$	\$
1.2.6	Gravel for Slope Drains	40	CY	\$	\$
1.2.7	HDPE Pipe	40	LF	\$	\$
1.2.8	Midslope Diversion Berms	300	LF	\$	\$
1.2.9	Midslope Diversion Channels	330	LF	\$	\$
1.2.10	Rip-Rap for Riverbank Protection	120	SY	\$	\$
1.2.11	Seeding	4000	SY	\$	\$
	Total	Estimated	Amount		\$

In the event there is a difference between a unit price and the extended total, the unit price will be held to be the intended bid. If the bidder

shows only the total price but fails to enter a unit price, the total divided by the estimated quantity will be held to be the intended unit price.

-- End of Document --

SECTION 01 11 00

SUMMARY OF WORK 06/06

PART 1 GENERAL

1.1 SUMMARY

On or about 13 June 2006, field maintenance personnel detected a partial failure of the Ormet Primary Aluminum Corporation (Ormet) Construction Materials Scrap Dump (CMSD) landfill multilayer cap on the river (southern) side of the CMSD landfill.

The multilayer cap consists of the following layers, listed from the top down:

- 2.0 to 2.4 ft. vegetative support layer (VSL)
- Nonwoven geotextile filter fabric (Synthetic Industries Geotex 801)
- Geonet drainage layer (Poly-Net PN3000)
- 40 mil textured HDPE geomembrane (Columbia Geosystems)
- Geocomposite clay layer (GCL) (Bentofix NS)

The primary sliding surface lies along the interface above the nonwoven geotextile and below the VSL.

The work to be performed under this project consists of providing the labor, equipment, and materials to remove displaced material from the failed area of the CMSD multilayer cap and to repair the landfill cap in accordance with the Contract Documents.

The work consists of earthwork, sitework, and other items defined in the Contract Documents.

NOTE: To protect the HDPE geomembrane, no stakes for survey control, silt fence support, material placement, or other uses shall be used on the CMSD landfill cap without the written authOrization of the Owner's Representative.

1.2 PROJECT DESCRIPTION

The Project includes the activities and items listed below:

- Mobilization and Site Preparation , including clearing of trees and brush along the riverbank for access to the failed area of the CMSD landfill cap (Section 31 10 00), preparation of access road (Section 31 10 00), fence removal (Section 31 10 00), and erosion control (Section 31 25 13).
- Removal of Temporary Slope Protection (Section 31 10 00)
- Removal of Failed Slope Material (Section 31 00 00)
- Geomembrane (Section 31 05 19)
- Geonet (Section 31 05 19)
- Geotextile (Section 31 05 19)
- Vegetative Support Layer (Section 31 00 00)
- Gravel for Slope Drains (Section 31 00 00)
- HDPE Pipe (Section 31 00 00)
- Midslope Diversion Berms (Section 31 00 00)
- Midslope Diversion Channels (Section 31 00 00)
- Rip Rap for Riverbank Protection (Section 31 00 00)
- Seeding (Section 32 00 00)

- Site Restoration and Demobilization (Section 32 00 00)

1.3 CRITERIA FOR BIDDING

Base bids on the following criteria:

- a. Existing site descriptions, measurements, quantities, and elevations presented in the Contract Documents are believed to be correct, but it shall be the Contractor's option to visit the site and the Contractor's responsibility to inspect the site and to confirm the existing site conditions to the Contractor's satisfaction prior to submitting a bid.
- b. Pipes or other artificial obstructions, except those indicated, will not be encountered within the CMSD landfill cap, however pipes or other utilities may underly access roads.
- d. Groundwater will not be encountered on the slopes of the CMSD cap. Groundwater elevation is less than 10 feet below the existing surface elevation between the toe of the CMSD landfill cap and the river.
- g. Borrow material in the quantities required is not available at the project site.

1.4 EXISTING WORK

The Contractor shall protect existing vegetation, structures, equipment, utilities, pavement and improvements.

The Contractor shall remove or alter existing work in such a manner as to prevent injury or damage to any portions of the existing work which remain.

The Contractor shall repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as approved by the Owner's Representative. At the completion of operations, existing work shall be in a condition equal to or better than that which existed before new work started.

1.5 CONTRACT DRAWINGS

The following drawings accompany this specification and are a part thereof.

Drawing No. 1 CMSD Landfill, Plan View Drawing No. 2 Cross Sections

Contractor shall immediately check furnished drawings and notify Ormet's Representative of any discrepancies.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

SECTION 01 22 00

MEASUREMENT AND PAYMENT 04/06

PART 1 GENERAL

1.1 LUMP SUM PAYMENT ITEMS

Payment items for the work of this contract for which contract lump sum payments will be made are listed in the BIDDING SCHEDULE and described below. All costs for items of work, which are not specifically mentioned to be included in a particular lump sum or unit price payment item, shall be included in the listed lump sum item most closely associated with the work involved. The lump sum price and payment made for each item listed shall constitute full compensation for furnishing all plant, labor, materials, and equipment, and performing any associated Contractor quality control, environmental protection, meeting safety requirements, tests and reports, and for performing all work required for which separate payment is not otherwise provided.

1.1.1 Mobilization and Site Preparation (No Section reference)

1.1.1.1 Payment

Payment will be made for costs associated with operations necessary for mobilization and site preparation, including clearing of trees and brush along the riverbank for access to the failed area, preparation of access road, fence removal, and erosion control.

1.1.1.2 Unit of Measure

Unit of measure: lump sum.

1.1.2 Removal of Temporary Slope Protection
 (No Section reference)

1.1.2.1 Payment

Payment will be made for costs associated with the removal and disposal of materials used for temporary slope protection.

1.1.2.2 Unit of Measure

Unit of measure: lump sum.

1.1.3 Site Restoration and Demobilization (No Section reference)

1.1.3.1 Payment

Payment shall be made at the contract lump sum price which shall be full compensation for removal of temporary construction signs and fencing, removal of erosion control measures, removal of any temporary facilities, removal of equipment, reconstruction of permanent fencing, final site restoration, and final site cleanup. This item includes all work and

expenses incidental thereto, for which payment is not provided under other items.

1.1.3.2 Unit of Measure

Unit of measure: lump sum.

1.2 UNIT PRICE PAYMENT ITEMS

Payment items for the work of this contract on which the contract unit price payments will be made are listed in the BIDDING SCHEDULE and described below. The unit price and payment made for each item listed shall constitute full compensation for furnishing all plant, labor, materials, and equipment, and performing any associated Contractor quality control, environmental protection, meeting safety requirements, tests and reports, and for performing all work required for each of the unit price items.

1.2.1 Removal of Failed Slope Material (Section 31 00 00)

1.2.1.1 Payment

Payment will be made for costs associated with operations necessary for the removal of soil, riprap, vegetation, and other displaced materials, including haul and disposition.

1.2.1.2 Measurement

The total quantity of excavated material for which payment will be made will be determined by truck count as approved by the Owner's.

The total quantity of excavated material for which payment will be made includes both displaced material from the failed area of the CMSD multilayer cap and material within and along the periphery of the failed area of the CMSD multilayer cap removed at the direction of the Owner's Representative. It does not include material removed for the construction of the midslope diversion channels.

The volume (V) will be determined by calculating the original in-place volume of the material from the failed area of the CMSD multilayer cap and increasing that volume by an appropriate expansion factor to reflect an increase in void ratio for loose soil relative to the in-place soil. The volume shall equal the area (A) within the limits of soil removal on the cap approved by the Owner's Representative multiplied by the average thickness (T) of the original VSL soil. The thickness of the original VSL soil will be defined as the greater of either 2.4 feet or the average thickness derived from a representative number of measurements around the perimeter of area (A). The expansion factor equals 1.25.

The total quantity of excavated material for which payment will be made will be calculated as V = A*T*1.25.

1.2.1.3 Unit of Measure

Unit of measure: cubic yard.

1.2.2 Geomembrane (Section 31 05 19)

1.2.2.1 Payment

Payment will be made for costs associated with furnishing, transporting, and installing geomembrane as specified.

1.2.2.2 Measurement

The total quantity of geomembrane for which payment will be made will be area of geomembrane installed and approved by the Owner's Representative. No allowance will be made for waste, overlap, repairs, or materials used for the convenience of the Contractor.

1.2.2.3 Unit of Measure

Unit of measure: square yard.

1.2.3 Geosynthetic Drainage Layer (Section 31 05 19)

1.2.3.1 Payment

Payment will be made for costs associated with furnishing, transporting, and installing geonet drainage material as specified.

1.2.3.2 Measurement

The total quantity of geonet for which payment will be made will be area of geonet installed and approved by the Owner's Representative. No allowance will be made for waste, overlap, repairs, or materials used for the convenience of the Contractor.

1.2.3.3 Unit of Measure

Unit of measure: square yard.

1.2.4 Geotextile (Section 31 05 19)

1.2.4.1 Payment

Payment will be made for costs associated with furnishing, transporting, and installing geotextile as specified.

1.2.4.2 Measurement

The total quantity of geotextile for which payment will be made will be area of geotextile installed and approved by the Owner's Representative. No allowance will be made for waste, overlap, repairs, or materials used for the convenience of the Contractor.

1.2.4.3 Unit of Measure

Unit of measure: square yard.

1.2.5 Vegetative Support Layer (Section 31 00 00)

1.2.5.1 Payment

Payment shall be made at the contract unit price which shall be full compensation for all labor, equipment, tools, and other materials required to furnish, transport, place, grade, and compact soil for the Vegetative Support Layer (VSL) in accordance with the Specifications. Payment under this item include the development of borrow sources, purchase of borrow soil, all offsite and onsite handling, excavation, hauling, stockpiling, loading, unloading, spreading, compaction, testing, and other work required to construct the Vegetative Support Layer. This item excludes any payment for VSL soil replaced as part of the construction of the Midslope Diversion Channel. This item encompasses all work and expenses incidental thereto, for which payment is not provided under other items.

1.2.5.2 Measurement

The total quantity of VSL soil for which payment shall be made will be the volume placed in accordance with the Specifications.

1.2.5.3 Unit of Measure

Unit of measure: cubic yard

1.2.6 Gravel for Slope Drains (Section 31 00 00)

1.2.6.1 Payment

Payment shall be made at the contract unit price which shall be full compensation for all labor, equipment, tools, and other materials required to furnish, transport, place, and grade gravel for the Slope Toe Drain and the Midslope Diversion Channel in accordance with the Specifications. Payment under this item include the purchase of gravel, compliance testing of gravel, all offsite and onsite handling, stockpiling, loading, unloading, spreading, and grading of the gravel. This item encompasses all work and expenses incidental thereto, for which payment is not provided under other items.

1.2.6.2 Measurement

The total quantity of gravel for which payment shall be made will be the theoretical area of the gravel cross section of the Slope Toe Drain shown in the drawings multiplied by the length of the Slope Toe Drain installed along the toe of the slope plus the theoretical area of the gravel cross section of the Midslope Drain shown in the drawings multiplied by the length of the Midslope Drain installed along the midslope diversion channel.

1.2.6.3 Unit of Measure

Unit of measure: cubic yard

1.2.7 HDPE Pipe (Section 31 00 00)

1.2.7.1 Payment

Payment shall be made at the contract unit price which shall be full compensation for all labor, equipment, tools, and other materials required to furnish, transport, prepare, and place HDPE pipe for the Perimeter Toe Drain or transitions to the Slope Toe Drain in accordance with the Specifications. Payment under this item include the purchase of HDPE pipe,

all offsite and onsite handling, stockpiling, loading, unloading, preparation, and installation of the pipe. This item encompasses all work and expenses incidental thereto, for which payment is not provided under other items.

1.2.7.2 Measurement

The total quantity of HDPE pipe for which payment shall be made will be the length placed in accordance with the Specifications.

1.2.7.3 Unit of Measure

Unit of measure: linear foot

1.2.8 Midslope Diversion Berms (Section 31 00 00)

1.2.8.1 Payment

Payment will be made for costs associated with constructing midslope diversion berms. Payment includes all costs associated with furnishing, transporting, stockpiling (if applicable), and placing materials required to construct the midslope diversion berms as specified.

1.2.8.2 Measurement

The total quantity of midslope diversion berms for which payment will be made will be the length of midslope diversion berms constructed as specified and approved by the Owner's Representative.

1.2.8.3 Unit of Measure

Unit of measure: linear foot.

1.2.9 Midslope Diversion Channels (Section 31 00 00)

1.2.9.1 Payment

Payment will be made for costs associated with constructing midslope diversion channels. Payment includes all costs associated with excavating VSL soil above the existing upper diversion berm to expose the geomembrane, as well as furnishing, transporting, stockpiling (if applicable), and backfilling VSL soil required to construct the midslope diversion channels as specified. This item excludes the costs of geosynthetic materials and gravel.

1.2.9.2 Measurement

The total quantity of midslope diversion channel for which payment will be made will be the length of midslope diversion channel constructed as specified and approved by the Owner's Representative.

1.2.9.3 Unit of Measure

Unit of measure: linear foot.

Page 12

- 1.2.10 Rip-Rap for Riverbank Protection (Section 31 00 00)
- 1.2.10.1 Payment

Payment will be made for costs associated with restoring the riverbank protection. Payment includes all costs associated with furnishing, transporting, stockpiling (if applicable), and placing materials required to construct the riverbank protection as specified.

1.2.10.2 Measurement

The total quantity of riverbank protection for which payment will be made will be the area of riverbank protection restored as specified and approved by the Owner's Representative.

1.2.10.3 Unit of Measure

Unit of measure: square yard.

1.2.11 Seeding (Section 32 00 00)

1.2.11.1 Payment

Payment shall be made at the contract unit price which shall be full compensation for all labor, equipment, tools, and other materials required to prepare the ground surface for seeding, including to furnish and to place grass seed, fertilizer, and mulch in all disturbed areas requiring restoration. This item includes maintaining new seeding through the contract maintenance period. This item includes all work and expenses incidental thereto, for which payment is not provided under other items.

1.2.11.2 Measurement

The quantity to be measured shall be the actual area requiring seeding as measured by the Contractor and approved by the Owner's Representative.

1.2.11.3 Unit of Measure

Unit of Measure: Square yard

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

-- End of Section --

SECTION 01 33 00

SUBMITTAL PROCEDURES 10/06

PART 1 GENERAL

1.1 DEFINITIONS

1.1.1 Submittal Descriptions (SD)

Submittals requirements are specified in the technical sections.

SD-01 Preconstruction Submittals

Information supplied by the Contractor related to procedures for executing the Project, such as proposed subcontractors, work plans, health and safety plans, construction quality control plans, and schedule.

SD-02 Shop Drawings

Drawings, diagrams and schedules specifically prepared to illustrate some portion of the work.

Diagrams and instructions from a manufacturer or fabricator for use in producing the product and as aids to the Contractor for integrating the product or system into the project.

Drawings prepared by or for the Contractor to show how multiple systems and interdisciplinary work will be coordinated.

SD-03 Product Data

Catalog cuts, illustrations, schedules, diagrams, performance charts, instructions and brochures illustrating size, physical appearance and other characteristics of materials, systems or equipment for some portion of the work.

Samples of warranty language when the contract requires extended product warranties.

SD-04 Samples

Fabricated or unfabricated physical examples of materials, equipment or workmanship that illustrate functional and aesthetic characteristics of a material or product and establish standards by which the work can be judged.

Color samples from the manufacturer's standard line (or custom color samples if specified) to be used in selecting or approving colors for the project.

Field samples and mock-ups constructed on the project site establish standards by which the ensuring work can be judged. Includes assemblies or portions of assemblies which are to be incorporated into the project and those which will be removed at conclusion of the work.

SD-06 Test Reports

Report by a testing laboratory that a material, product or system identical to the material, product or system to be provided has been tested in accord with specified requirements. (Testing must have been within three years of date of contract award for the project.)

Report which includes finding of a test made at the job site or on sample taken from the job site, on portion of work during or after installation.

Investigation reports.

Daily logs and checklists.

Final acceptance test and operational test procedure.

SD-07 Certificates

Statements printed on the manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements. Must be dated after award of project contract and clearly name the project.

SD-11 Closeout Submittals

Special requirements necessary to properly close out a construction contract, such as As Built drawings.

1.1.2 Approving Authority

All submittals are subject to the review and acceptance of the Owner's Representative. Acceptance of a submittal shall not relax or modify any of the project requirements detailed in this specification unless such modification is given to the Contractor in writing.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

SECTION 01 35 23

OWNER SAFETY REQUIREMENTS 06/06

PART 1 GENERAL

1.1 SUMMARY

The requirements of this Section apply to, and are a component part of, each section of the specifications.

1.2 GENERAL SAFETY PROVISIONS

Contractor shall take safety and health measures in performing work under this Contract. Contractor shall meet with the Owner's Representative to develop a mutual understanding relative to administration of the safety plan. Contractor is subject to applicable federal, state, and local laws, regulations, ordinances, codes, and orders relating to safety and health in effect on the date of this Contract.

During the performance of work under this Contract, the Contractor shall comply with procedures prescribed for control and safety of persons visiting the project site. Contractor is responsible for his personnel and for familiarizing each of his subcontractors with safety requirements. Contractor shall advise the Owner's Representative of any special safety restriction he has established so that Owner's personnel can be notified of these restrictions.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

SECTION 01 45 00

CONSTRUCTION QUALITY CONTROL 07/06

PART 1 GENERAL

1.1 SUBMITTALS

SD-01 Preconstruction Submittals
List of Proposed Subcontractors
Construction Work Plan
Construction Schedule
Construction Quality Control (QC) Plan
Health and Safety Plan

SD-03 Product Data Geonet Geotextile HDPE Pipe

SD-06 Test Reports
Vegetative Soil Layer Soil
Gravel
Testing Plan and Log
Daily Production and QC Report

SD-07 Certificates
Geonet
Geotextile
HDPE Pipe
Vegetative Soil Layer Soil
Gravel

SD-11 Closeout Submittals
As-Built Drawings

1.2 PRECONSTRUCTION SUBMITTALS

At least 7 days prior to the start of construction, the Contractor shall provide to the Owner's Representative the following submittals:

List of Proposed Subcontractors that will be employed by the Contractor and a description of the services these firms will provide.

Construction Work Plan that documents the proposed construction methods, construction sequence, and responsibilities for the construction of the Project.

Construction Schedule that details the sequence of, interrelationships among, and schedule for the construction activities.

Construction Quality Control (QC) Plan that describes the responsibilities for meeting the testing, certification, and measurement requirements of the Contract Documents. The Construction Quality Control (QC) Planshall include a copy of the form for the Testing Plan and Log.

Health and Safety Plan identifying Contractor personnel responsible for site safety, and documenting Contractor's safety requirements, Contractor's safety communication and training

procedures, Contractor's safety inspection procedures, and Contractor's safety incident tracking, reporting, and improvement procedures.

1.3 PRODUCT DATA SUBMITTALS

Product Data Submittals are required for the following manufactured products. Specific requirements are listed in the referenced sections of the specifications.

```
Geonet (Section 31 05 19)
Geotextile (Section 31 05 19)
HDPE Pipe (Section 31 00 00)
```

1.4 TEST REPORT SUBMITTALS

1.4.1 Material Test Reports

The following Test Report Submittals are required. Where indicated, specific requirements are listed in the referenced sections of the specifications.

```
Vegetative Soil Layer Soil (Section 31 00 00)
Gravel (Section 31 00 00)
```

1.4.2 Testing Plan and Log

As tests are performed, the Contractor shall record on a Testing Plan and Log the date the test was performed and the date the test results were forwarded to the Owner's Representative. Deliver a copy of the updated Testing Plan and Log to the Owner's Representative each week.

1.4.3 Daily Production and QC Report

The Contractor shall deliver the Daily Production and QC Report to the Owner's Representative by 10:00 AM the next working day after each day that work is performed. The report shall include:

- a. Contractor Production Data, including daily and cumulative quantities constructed or installed
- b. Construction QC Data, including the results of any field tests performed or laboratory test data received
- c. Problem Occurrence and Resolution Narrative, including a description of any problems or anomalies encountered and their resolution

1.5 CERTIFICATE SUBMITTALS

Certificate Submittals are required from the providers of the following manufactured and natural materials. Specific requirements are listed in the referenced sections of the specifications.

```
Geonet (Section 31 05 19)
Geotextile (Section 31 05 19)
HDPE Pipe (Section 31 00 00)
Vegetative Soil Layer Soil (Section 31 00 00)
Gravel (Section 31 00 00)
```

1.6 COMPLETION INSPECTIONS

1.6.1 Punch List Inspection

Near the completion of all work, the Contractor and the Owner's Representative shall conduct an inspection of the work and develop a "punch list" of items which do not conform to the approved drawings, specifications and Contract. Include in the punch list any remaining items on the "Rework Items List", which were not corrected prior to the Punch List Inspection. The punch list shall include the estimated date by which the deficiencies will be corrected.

1.6.2 Final Acceptance Inspection

The Contractor shall notify the Owner's Representative when all items previously identified on the pre-final punch list have been completed or corrected. The Contractor and the Owner's Representative shall conduct a final inspection of the work. If all items are completed in accordance with the specifications, drawings, and punch list, the project will be accepted for final payment.

1.7 DOCUMENTATION

1.7.1 Construction Documentation

Daily Production and QC Reports are required for each day that work is performed. Maintain current and complete records of on-site and off-site QC program operations and activities. The reporting of work shall be identified by terminology consistent with the specifications. The reports shall include pertinent information including directions received, problems encountered during construction, work progress and delays, conflicts or errors in the drawings or specifications, field changes, safety hazards encountered, instructions given and corrective actions taken, delays encountered and a record of visitors to the work site, quality control problem areas, construction deficiencies encountered, and meetings held.

1.7.2 As-Built Drawings

The Contractor shall prepare and submit As-Built Drawings, marked to show deviations which have been made from the Contract drawings. Upon completion of work, the Contractor shall furnish a certificate attesting to the accuracy of the As-Built Drawings prior to submission to the Owner's Representative.

As-Built Drawings drawings shall incorporate contract changes and plan deviations. Lines, letters, and details will be sharp, clear, and legible. Additions or corrections to the drawings will be drawn to the scale of the original drawing.

Three reproducible copy(s) of each drawing shall be submitted for the historical record. If the As-Built Drawings are produced on a CAD system, 3 copies of the electronic files on CD or DVD shall also be submitted.

1.8 NOTIFICATION ON NON-COMPLIANCE

The Owner's Representative will notify the Contractor of any detected non-compliance with the Contract. The Contractor shall take immediate corrective action after receipt of such notice. Such notice, when

delivered to the Contractor at the work site, shall be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders shall be made the subject of claim for extension of time for excess costs or damages by the Contractor.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 PREPARATION

Designate receiving/storage areas for incoming material to be delivered according to installation schedule and to be placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. Store and handle materials in a manner as to prevent loss from weather and other damage. Keep materials, products, and accessories covered and off the ground, and store in a dry, secure area. Prevent contact with material that may cause corrosion, discoloration, or staining. Protect all materials and installations from damage by the activities of other trades.

-- End of Section --

SECTION 31 00 00

EARTHWORK 07/06

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D 422	(1963; R 2002) Particle-Size Analysis of Soils
ASTM D 698	(2000ae1) Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/cu. ft. (600 kN-m/cu. m.))
ASTM D 2216	(2005) Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D 2487	(2000) Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 3080	(2004)Standard Test Method for Direct Shear Test of Soils Under Consolidated Drained Conditions
ASTM D 4318	(2000) Liquid Limit, Plastic Limit, and Plasticity Index of Soils

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01 33 00 ${\tt SUBMITTAL\ PROCEDURES:}$

SD-01 Preconstruction Submittals Construction Work Plan

SD-06 Test Reports

Borrow Source Assessment VSL Soil Moisture Content and Density Tests

1.3 EQUIPMENT

Equipment used to place the select fill and topsoil layers shall be as described in the approved Construction Work Plan. The plan shall describe equipment to be used (including ground pressures). Equipment shall not accelerate or brake suddenly, turn sharply, or be operated at speeds exceeding 5.0 miles per hour.

PART 2 PRODUCTS

2.1 VEGETATIVE SUPPORT LAYER SOIL

2.1.1 VSL Soil Description

VSL soil shall consist of natural, friable soil and shall be free of debris, frozen materials, angular rocks, clay lumps, objectionable weeds, litter, brush, matted roots, chemical contamination, toxic substances, and any material that might be harmful to plant growth or be a hindrance to grading, planting, or maintenance operations.

VSL soil shall have sufficient fertility to support vegetation.

2.1.2 Classification Testing

Borrow source assessment tests shall be performed on the material proposed for use in the vegetative support layer to ensure compliance with specified requirements. At least one set of borrow assessment tests shall be performed on each borrow source proposed for use. A set of borrow source assessment tests shall consist of Atterberg limits (ASTM D 4318), particle size analysis (ASTM D 422), and moisture content (ASTM D 2216). Based on borrow source assessment testing, soils shall be classified in accordance with ASTM D 2487.

2.1.3 Moisture-Density (Compaction) Testing

A representative sample from each principal type or combination of borrow materials shall be tested to establish compaction curves using $\overline{\text{ASTM D 698}}$. At least one compaction test shall be performed on each borrow source proposed. A minimum of 5 points shall be used to develop each compaction curve.

TABLE 1
VEGETATIVE SUPPORT LAYER SOIL TESTING FREQUENCIES

Property	Frequency (Note 1)	Test Method
Grain size analysis	Once,project start	ASTM D 422
Moisture content	Once (Note 2)	ASTM D 2216
Atterberg limits	Once,project start	ASTM D 4318
Compaction	Once,project start	ASTM D 698
Direct shear	Once,project start	ASTM D 3080

Note 1: The Owner's Representative may require additional tests if the soil characteristics of the incoming soil appear to change as the Project progresses.

Note 2: Additional moisture content tests will be taken daily as part of compaction control.

2.1.4 Chemical Contamination Certification

Borrow used for the Vegetative Support Layer shall be certified by the Contractor to be free of chemical contamination.

2.1.5 VSL Borrow Soil Acceptance Criteria

Test results must comply with the requirements listed in Table 2 or the

material will be rejected for use.

TABLE 2
REQUIRED PHYSICAL PROPERTIES OF VSL SOIL

Property	Test Value	
Soil classification	Low plasticity clay (CL)	ASTM D 2487
Max. particle size	1.0 inch	ASTM D 422
Liquid Limit	39% +/-5%	ASTM D 4318
Plasticity Index	22% +/-5%	ASTM D 4318
Friction Angle	32 degrees	ASTM D 3080

2.2 MATERIAL FOR RIP-RAP

2.2.1 Rip-Rap for Riverbank Protection

Provide rock conforming to Ohio DOT Type C for reconstruction of riverbank erosion protection. Type C material has at least 85 percent of the total material by weight larger than a 6-inch (150 mm) but less than an 18-inch (0.5 m) square opening and at least 50 percent of the total material by weight larger than a 12-inch (0.3 m) square opening. Furnish material smaller than a 6-inch (150 mm) square opening that consists predominantly of rock spalls and rock fines, and that is free of soil.

Provide rock fragments sufficiently durable to ensure permanence in the structure and the environment in which it is to be used. Use rock fragments free from cracks, seams, and other defects that would increase the risk of deterioration from natural causes. Do not permit the inclusion of more than trace quantities of dirt, sand, clay, and rock fines.

Salvage and reuse of rip-rap disturbed by the displacement of the CMSD landfill cover soils is encouraged.

2.2.2 Rip-Rap for Midslope Diversion Berms

Provide rock conforming to Ohio DOT Type D for construction of Midslope Diversion Berms. Type D material has at least 85 percent of the total material by weight larger than a 3-inch (75 mm) but less than a 12-inch (0.3 m) square opening and at least 50 percent of the total material by weight larger than a 6-inch (150 mm) square opening. Furnish material smaller than a 3-inch (75 mm) square opening that consists predominantly of rock spalls and rock fines, and that is free of soil.

Provide rock fragments sufficiently durable to ensure permanence in the structure and the environment in which it is to be used. Use rock fragments free from cracks, seams, and other defects that would increase the risk of deterioration from natural causes. Do not permit the inclusion of more than trace quantities of dirt, sand, clay, and rock fines.

Salvage and reuse of rip-rap disturbed by the displacement of the CMSD landfill cover soils is encouraged.

2.3 GRAVEL FOR SLOPE DRAINS

Above the midslope diversion channel, the geonet drain and geotextile will be extended across the midslope diversion channel to allow drainage of the upper portion of the slope. At the slope toe of the section to be repaired, the geonet drain and geotextile will be extended to the ground surface to allow drainage of the lower portion of the slope. The Contractor shall protect the exposed geonet and geotextile in both locations by covering the geotextile with a gravel blanket.

The gravel blanket shall have a minimum thickness of 3 inches.

Gravel for the protective gravel blanket shall meet the gradation criteria for AASHTO M43 Size No. 6. See Table 2.

Table 2
Gravel Gradation Requirements

Sieve Size in inches	Percent Finer	
1	100	
3/4	90 to 100	
1/2	20 to 55	
3/8	0 to 15	
No. 4	0 to 5	

2.4 WATER

Unless otherwise directed, water for moisture control of soil materials is the responsibility of the Contractor. If not prohibited by local regulations, river water may be used.

2.5 HDPE PIPE

The outlet pipes and elbows shall be nominally 4 inch diameter HDPE plastic pipe and fittings compatible with the perimeter drain pipe. All connections shall be watertight and mechanically secured by means approved by the Owner's Representative.

PART 3 EXECUTION

3.1 MATERIAL STOCKPILING

The Contractor shall stockpile and store all construction materials in a secure manner, protecting them from damage from construction traffic, water, and sun. Do not place material on surfaces that are muddy, frozen, or contain frost.

Storage or stockpiling of material on the slope will not be permitted.

3.2 REMOVAL OF FAILED SLOPE MATERIAL

The Contractor shall remove displaced material at the toe of the failed area of the CMSD multilayer cap, restoring the area to the grades and lines existing prior to the displacement of the cap materials. The Contractor shall also remove any unsuitable material on the CMSD multilayer cap within and along the periphery of the failed area at the direction of the Owner's Representative.

The procedures and equipment used shall not elongate, wrinkle, cut, puncture, scratch, or otherwise damage the geosynthetic layers.

Geosynthetic layers damaged during installation shall be replaced or repaired, at the Owner's Representative's discretion, at the Contractor's expense.

3.3 VSL PLACEMENT AND COMPACTION

3.3.1 General Placement Procedures

VSL soil shall not be placed when the subgrade is frozen, excessively wet, extremely dry, or in a condition otherwise detrimental to proper grading. No equipment shall be operated directly on the top surface of geosynthetics. VSL soil shall be placed in a manner that prevents soil from entering the geotextile overlap zone. VSL soil shall be pushed out over the geotextile in an upward tumbling motion so that tensile stresses are not mobilized in the geotextile and so that wrinkles in the geosynthetics do not fold over. Soil shall not be dropped directly onto the geotextile from a height greater than 3 feet. On slopes, select fill shall be placed from the bottom of the slope upward. No equipment shall be operated directly on top of the geotextile.

Fill and backfill to contours, elevations, and dimensions indicated; to match existing lines and grades of undisturbed areas; and in accordance with the instuctions of the Owner's Representative. Compact each lift before placing overlying lift.

3.3.2 Construction Tolerances

Finished surfaces shall be uniformly graded and shall be free from depressions, mounds, or windrows. The top surface of the Vegetative Support Layer shall be no greater than 3 inches above the lines and grades shown on the drawings. No minus tolerance will be permitted. Rigid grade stakes shall not be driven into the Vegetative Support Layer to control placement.

3.3.3 Initial Lift of VSL Soil Placed Over Geosynthetics

The first lift of VSL soil placed over geosynthetics shall be a minimum of 9 inches and a maximum of 12 inches in loose thickness. Equipment with ground pressures less than 7 psi shall be used to place and traffic compact the first lift of VSL soil. Traffic compaction shall consist of a minimum of 2 passes over all areas. Compact areas not accessible to rollers or compactors with mechanical hand tampers.

3.3.4 Subsequent Lifts of VSL Soil

The loose lift thickness of each subsequent lift shall be no greater than 8 inches. Full scale placement and compaction equipment shall be allowed on areas underlain by geosynthetics after the second loose lift of soil has been placed. Compaction shall consist of a minimum of 2 passes over all areas.

3.3.5 Construction Quality Assurance Testing

3.3.5.1 Test Frequencies and Locations

Each day that select fill is placed, a minimum of one set of field moisture

content and density tests shall be performed.

3.3.5.2 Test Results

Placement of select fill shall conform to the following requirements:

- a. The minimum allowable dry density shall be no less than 85 percent of maximum dry density obtained by the test procedure presented in ASTM D 698. Density requirements may be waived for the first lift of the Vegetative Support Layer at the discretion of the Owner's Representative.
- b. The allowable moisture content range shall be \pm 3 percent of the optimum moisture content obtained by the test procedure presented in ASTM D 698.

Field moisture content and density test results shall be compared to the compaction curve for the appropriate material type being tested. If test results are not within the acceptable range for moisture content or density, the lift of soil shall be recompacted or reworked to meet the specifications. The area shall then be retested.

The Contractor will advise the Owner's Representative of the VSL soil moisture content and density tests prior to placing the following lift.

3.4 RIP-RAP PLACEMENT

3.4.1 Rip-Rap for Riverbank Protection

The Contractor shall restore rip-rap for riverbank protection in the area disturbed by the failure of the CMSD landfill cap. Limits for rip-rap restoration shall be determined in the field with the Owner's Representative.

The Contractor shall place rip-rap for riverbank protection to a minimum thickness of 1.5 feet and a maximum slope of 2:1 (horizontal:vertical).

The Contractor shall place rock for rip-rap to produce a well graded mass with the minimum practicable percentage of voids.

3.4.2 Rip-Rap for Midslope Diversion Berms

The Contractor shall restore rip-rap for midslope diversion berms in the area disturbed by the failure of the CMSD landfill cap. Limits for rip-rap restoration shall be determined in the field with the Owner's Representative.

The Contractor shall place rip-rap for midslope diversion berms to provide a minimum channel depth of 1 foot and a maximum slopes of 2:1 (horizontal:vertical), both upslope and downslope.

The Contractor shall place rock for rip-rap to produce a well graded mass with the minimum practicable percentage of voids.

3.5 SLOPE TOE DRAIN

3.5.1 Description

The original CMSD landfill cap construction included a 4 inch diameter corrugated plastic perimeter drain pipe along the toe of the slope with several perpendicular outlet pipes. The current Project eliminates the perimeter drain pipe in the reconstructed section, but requires the installation of outlet pipes at the ends of the perimeter drain pipe at the sides of the failed section.

3.5.2 Toe Drain in Reconstructed Section

The Contractor shall extend the geomembrane, geosynthetic drainage layer, and geotextile past the toe of the slope as shown in the drawings. New geomembrane shall meet the requirements of Section 31 05 19

3.5.3 Transition at Edge of Reconstructed Section

The Contractor shall install an outlet pipe perpendicular to the perimeter drain pipe at each side of the failed area. The outlet pipes shall be connected to the perimeter drain pipe with elbows.

3.5.4 Additional Perimeter Drain Outlet Pipe

The Contractor shall install an additional outlet pipe perpendicular to the perimeter drain pipe at the east end of the south side of the CMSD landfill cap, such that any effluent from the outlet pipe discharges beyond the toe of the slope.

The Contractor shall locate the existing perimeter pipe by excavating a trench perpendicular to the perimeter drain pipe in a location at the toe of the slope anticipated to intersect the perimeter drain pipe, taking care not to damage the existing perimeter drain pipe or geosynthetic materials. Any damage to the geomembrane shall be repaired at no cost to the Owner. The Contractor shall make the initial trial excavation approximately 30 feet west of the east end of the slope. If the perimeter drain pipe does not exist at that location, the Contractor shall make additional trial excavations each 20 feet west of the previous excavation until the perimeter drain pipe is located.

The additional outlet pipe shall be connected to the perimeter drain pipe with an elbow, if the excavation intersects the end of the existing perimeter drain pipe, or with a tee, if the trench intersects the existing perimeter drain pipe elsewhere.

3.6 MIDSLOPE DIVERSION CHANNEL

3.6.1 Description

The original CMSD landfill cap construction included two midslope diversion berms on the southern slope to intercept surface water runoff and to direct its flow to the downchute. The current Project modifies the geosynthetic drainage layer above the upper midslope diversion berm to achieve the following objectives:

- a) hydraulically isolate the upslope and downslope portions of the geosynthetic drainage layer
- b) direct water from the upslope portion of the geosynthetic drainage layer to the slope surface and the midslope diversion channel

c) decrease the quantity of water in the geosynthetic drainage layer in the downslope portion of the slope

3.6.2 Removal of Vegetative Support Layer

The Contractor shall remove the Vegetative Support Layer immediately upslope of the Midslope Diversion Berm for a distance of approximately 8 feet. The upslope side of the excavation shall be no steeper than 2:1 (horizontal:vertical). The bottom of the excavation shall have a 5% downward slope toward the Midslope Diversion Berm. The excavation shall expose the existing geotextile, geonet, and geomembrane for at least 1 foot along the slope.

The Contractor shall use methods and equipment to prevent damage to the geosyntetic materials.

3.6.3 Cutting Geotextile and Geonet

The Contractor shall cut the geotextile and geonet to separate the upstream and downstream portions.

The Contractor shall use methods and equipment to prevent damage to the geomembrane.

3.6.4 Installing Geomembrane

The Contractor shall install geomembrane as shown in the drawings. The upstream edge shall be welded to the existing geomembrane. The geomembrane shall overlie the 5% slope to the Midslope Diversion Channel, and then follow the profile of the channel.

The Contractor shall install the geomembrane in accordance with the requirements of Section $31\ 05\ 19$.

3.6.5 Installing Geosynthetic Drainage Layer

The Contractor shall install geosynthetic drainage layer as shown in the drawings. The upstream edge shall be fastened to the existing geonet. The geosynthetic drainage layer shall overlie the 5% slope to the Midslope Diversion Channel, and then follow the profile of the channel.

The Contractor shall install the geosynthetic drainage layer in accordance with the requirements of Section 31 05 19.

3.6.6 Installing Geotextile

The Contractor shall install geotextile as shown in the drawings. The downsteam edge of the existing geotextile shall overlap the upstream edge of the new geotextile. The geotextile shall overlie the 5% slope to the Midslope Diversion Channel, and then follow the profile of the channel.

The Contractor shall install the geotextile in accordance with the requirements of Section 31 05 19.

3.6.7 Vegetative Support Layer

The Contractor shall reconstuct the Vegetative Support Layer to the original lines and grades.

3.6.8 Gravel Protection

The Contractor shall cover the exposed geotextile with a 3 inch layer of gravel.

3.7 PROTECTION OF EXISTING AND NEW CONSTRUCTION

3.7.1 Utilities

Movement of construction machinery and equipment over pipes and utilities during construction shall be at the Contractor's risk. Report damage to utility lines or subsurface construction immediately to the Owner's Representative.

3.7.2 Drainage and Dewatering

Provide for the collection and disposal of surface and subsurface water encountered during construction.

3.7.2.1 Drainage

The Contractor shall maintain grades in the construction area to provide positive surface water runoff away from the construction activity and/or provide temporary ditches, swales, and or drainage features as required to maintain dry soils and prevent erosion. It is the responsibility of the Contractor to assess the soil and ground water conditions at the site and to employ necessary measures to permit construction to proceed. Slopes and backfill surfaces shall be protected to prevent erosion and sloughing. Excavation shall be performed so that the site, the area immediately surrounding the site, and the area affecting operations at the site shall be continually and effectively drained.

3.7.2.2 Repair of Erosion Damage

Erosion rills or other damage that occurs shall be repaired and grades re-established at the Contractor's expense. Repairs to the Vegetative Support Layer shall be documented including location and volume of soil affected, corrective action taken, and results of retests.

-- End of Section --

SECTION 31 05 19

GEOSYNTHETICS FOR EARTHWORK 04/06

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D 638	(2003) Tensile Properties of Plastics
ASTM D 1004	(2003) Initial Tear Resistance of Plastic Film and Sheeting
ASTM D 1505	(2003) Density of Plastics by the Density-Gradient Technique
ASTM D 1603	(2001) Carbon Black in Olefin Plastics
ASTM D 3786	(2001) Hydraulic Bursting Strength of Textile Fabrics-Diaphragm Bursting Strength Tester Method
ASTM D 4218	(1996; R 2001) Determination of Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique
ASTM D 4354	(1999) Sampling of Geosynthetics for Testing
ASTM D 4355	(2002) Deterioration of Geotextiles from Exposure to Light, Moisture and Heat in a Xenon-Arc Type Apparatus
ASTM D 4491	(1999; R 2004) Water Permeability of Geotextiles by Permittivity
ASTM D 4533	(2004) Trapezoid Tearing Strength of Geotextiles
ASTM D 4632	(1991; R 2003) Grab Breaking Load and Elongation of Geotextiles
ASTM D 4716	(2003) Determining the (In-Plane) Flow Rate Per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head
ASTM D 4751	(2004) Determining Apparent Opening Size of a Geotextile

ASTM D 4759	(2002) Determining the Specification
	Conformance of Geosynthetics
ASTM D 4833	(2000e1) Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
ASTM D 4873	(2002) Identification, Storage, and Handling of Geosynthetic Rolls and Samples
ASTM D 5035	(1995; R 2003) Breaking Force and Elongation of Textile Fabrics (Strip Method)
ASTM D 5199	(2001) Measuring Nominal Thickness of Geosynthetics
ASTM D 5261	(1992; R 2003) Measuring Mass Per Unit Area of Geotextiles
ASTM D 5321	(2002) Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method
ASTM D 5397	(1999e1) Evaluation of Stress Crack Resistance of Polyolefin Geomembranes Using Notched Constant Tensile Load Test
ASTM D 6392	(1999) Determining the Integrity of Nonreinforced Geomembrane Seams Produced Using Thermo-Fusion Methods
GEOSYNTHETIC INSTITUTE	(GSI)
GSI GRI GC7	(1997) Determination of Adhesion and Bond Strength of Geocomposites
GSI GRI GM12	(1998) Asperity Measurement of Textured Geomembranes Using a Depth Gauge

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01 33 00 ${\tt SUBMITTAL\ PROCEDURES:}$

SD-02 Shop Drawings

Geomembrane As-Built Drawings

Final as-built drawings of geomembrane installation

SD-04 Samples

Geotextile Samples

One properly identified 24 by 24 inch minimum size geotextile sample.

Geosynthetic Drainage Layer Samples

One properly identified 24 by 24 inch minimum size geosynthetic

drainage layer sample. The fasteners proposed for use and the method of seaming and overlapping shall also be submitted.

Geomembrane Samples

One properly identified 24 by 24 inch minimum size geomembrane layer sample.

SD-06 Test Reports

Geotextile Certifications

Manufacturer's quality control test results.

Geosynthetic Drainage Layer Certifications

Manufacturer's quality control test results.

Geomembrane Tests

Manufacturer's quality control test results.

Geomembrane Laboratory Testing Geomembrane Trial Seam Testing Non-Destructive Field Seam Continuity Testing Destructive Field Seam Strength Testing

Interface Friction Testing

1.3 DELIVERY, STORAGE AND HANDLING

Delivery, storage, and handling of geosynthetics shall be in accordance with ASTM D 4873. Equipment used in performance of the work shall be in accordance with the geosynthetic manufacturer's recommendations and shall be maintained in satisfactory working condition.

1.3.1 Geotextile

The Owner's Representative shall be notified a minimum of 24 hours prior to delivery and unloading of geotextile rolls. Rolls shall be packaged in an opaque, waterproof, protective plastic wrapping. The plastic wrapping shall not be removed until deployment. If quality assurance samples are collected, rolls shall be immediately rewrapped with the plastic wrapping. Geotextile or plastic wrapping damaged during storage or handling shall be repaired or replaced, as directed. Each roll shall be labeled with the manufacturer's name, geotextile type, roll number, roll dimensions (length, width, gross weight), and date manufactured.

Rolls of geotextile shall be protected from construction equipment, chemicals, sparks and flames, temperatures in excess of 160 degrees F, or any other environmental condition that may damage the physical properties of the geotextile. To protect geotextile from becoming saturated, rolls shall either be elevated off the ground or placed on a sacrificial sheet of plastic in an area where water will not accumulate.

Geotextile rolls shall be handled and unloaded with load carrying straps, a fork lift with a stinger bar, or an axial bar assembly. Rolls shall not be dragged along the ground, lifted by one end, or dropped to the ground.

1.3.2 Geosynthetic Drainage Layer

The geosynthetic drainage layer material shall not be damaged during shipping, storage, or handling. Any drainage layer material found to be

damaged shall be repaired or replaced. Material shall be delivered only after the required submittals have been approved. Each roll shall be labelled with the manufacturer's name, product identification, lot number, roll number, and roll dimensions. Rolls that have attached geotextiles shall be individually wrapped in plastic. The rolls shall be stored in a level and dry area.

1.3.3 Geomembrane

1.3.3.1 Delivery

The QC inspector shall be present during delivery and unloading of the geomembrane. Each geomembrane roll/panel shall be labeled with the manufacturer's name, product identification number, roll/panel number, and roll dimensions.

1.3.3.2 Storage

Temporary storage at the project site shall be on a level surface, free of sharp objects where water cannot accumulate. The geomembrane shall be protected from puncture, abrasion, excessive heat or cold, material degradation, or other damaging circumstances. Storage shall not result in crushing the core of roll goods or flattening of the rolls. Rolls shall not be stored more than two high. Palleted materials shall be stored on level surfaces and shall not be stacked on top of one another. Ultraviolet sensitive materials shall be covered with a sacrificial opaque and waterproof covering or placed in a temporary shelter. Damaged geomembrane shall be removed from the site and replaced with geomembrane that meets the specified requirements.

1.3.3.3 Handling

Rolls/panels shall not be dragged, lifted by one end, or dropped. A pipe or solid bar, of sufficient strength to support the full weight of a roll without significant bending, shall be used for all handling activities. The diameter of the pipe or solid bar shall be small enough to be easily inserted through the core of the roll. Chains shall be used to link the ends of the pipe or bar to the ends of a spreader bar. The spreader bar shall be wide enough to prevent the chains from rubbing against the ends of the roll. Alternatively, a stinger bar protruding from the end of a forklift or other equipment may be used. The stinger bar shall be at least three-fourths the length of the core and also must be capable of supporting the full weight of the roll without significant bending. If recommended by the manufacturer, a sling handling method utilizing appropriate loading straps may be used.

PART 2 PRODUCTS

2.1 GEOTEXTILE

Geotextile shall be a nonwoven pervious sheet of polymeric material and shall consist of long-chain synthetic polymers composed of at least 95 percent by weight polyolefins, polyesters, or polyamides. The use of woven slit film geotextiles (i.e. geotextiles made from yarns of a flat, tape-like character) will not be allowed. Stabilizers and/or inhibitors shall be added to the base polymer, as needed, to make the filaments resistant to deterioration by ultraviolet light, oxidation, and heat exposure. Regrind material, which consists of edge trimmings and other scraps that have never reached the consumer, may be used to produce the

geotextile. Post-consumer recycled material shall not be used. Geotextile shall be formed into a network such that the filaments or yarns retain dimensional stability relative to each other, including the edges. Geotextiles shall meet the requirements specified in Table 1. Where applicable, Table 1 property values represent minimum average roll values (MARV) in the weakest principal direction. Values for AOS represent maximum average roll values. The Contractor shall submit Geotextile Certifications and test results from the manufacturer demonstrating that the product meets the Project specifications.

TABLE 1
PHYSICAL REQUIREMENTS FOR GEOTEXTILE

PROPERTY	UNITS	ACCEPTABLE VALUES	TEST METHOD
Mass/Unit Area	oz/SY	8.0 (min)	ASTM D 5261
Grab Strength	lbs		ASTM D 4632
Grab Elongation	-	50 (min)	ASTM D 4632
Puncture Strength	lbs	120 (min)	ASTM D 4833
Burst Strength	lbs/in	290 (min)	ASTM D 3786
Trapezoid Tear	lbs	95 (min)	ASTM D 4533
Apparent Opening			
Size	U.S. Sieve	100 (max)	ASTM D 4751
Permittivity		1.80 (min)	ASTM D 4491
Ultraviolet		50 (max)	ASTM D 4355

The Manufacturer shall be responsible for establishing and maintaining a quality control program to assure compliance with the requirements of the specification. Documentation describing the quality control program shall be made available upon request. Manufacturing quality control sampling and testing shall be performed in accordance with the manufacturer's approved quality control manual. As a minimum, geotextiles shall be randomly sampled for testing in accordance with ASTM D 4354, Procedure A. Acceptance of geotextile shall be in accordance with ASTM D 4759. Tests not meeting the specified requirements shall result in the rejection of applicable rolls.

2.2 GEOSYNTHETIC DRAINAGE LAYER

The polymer used to manufacture the geonet component of the geosynthetic drainage layer shall be polyethylene which is clean and free of any foreign contaminants. Regrind material which consists of edge trimmings and other scraps may be used to manufacture the geonet; however, post-consumer recycled materials shall not be used.

The Contractor may supply either separate geotextile and geonet, or a geocomposite drainage material. If a geocomposite is used, the geonet shall be covered on one side with nonwoven geotextile. Geocomposite shall be

N# T NT T N#T TN#

created by heat bonding geotextile to the geonet. The geotextile shall not be bonded to the drainage net within 6 inches of the edges of the rolls.

The geosynthetic drainage layer shall conform to the property requirements listed in Table 2. Where applicable, Table 2 property values represent minimum average roll values (MARV). The value for AOS represents the maximum average roll value (MaxARV). If a geocomposite drainage material is used, the geotextile must meet the requirements in Table 1. The Contractor shall submit Geosynthetic Drainage Layer Certifications and test results from the manufacturer demonstrating that the product meets the Project specifications.

TABLE 2 - GEOSYNTHETIC DRAINAGE LAYER PROPERTIES

PROPERTY	TEST METHOD		MINIMUM TESTING FREQUENCY
GEONET			
Thickness, minimum avg, Note 1	ASTM D 5199	200 mil	100,000 SF
Polymer Density, minimum avg	ASTM D 1505	0.940 g/cc	100,000 SF
Carbon Black Content	ASTM D 1603 ASTM D 4218	2 percent	100,000 SF
Tensile Strength, minimum avg, Note 2	ASTM D 5035	45 lbs/in	100,000 SF
GEOCOMPOSITE			
Transmissivity, min, including attached geotextile Note 4		1x10E-3 m2/sec	200,000 SF
Geonet/Geotextile Adhesion, minimum avg, Note 5	GSI GRI GC7	0.5 lbs/inch	100,000 SF

Note 1: The diameter of the presser foot shall be 2.22 inches and the pressure shall be 2.9 psi. For other thickness options, see manufacturer's literature.

Note 2: This is the average peak value for five equally spaced machine direction tests across the roll width.

Note 3: Manufacturer's historical data.

Note 4: Manufacturing quality control transmissivity tests shall be measured using a gradient of 1.0 under a normal pressure of 100 psi. A minimum seating period of 15 minutes shall be used. The test shall be performed between rigid end platens.

Note 5: Average of five tests across the roll width. Discounting the outer 305 mm of each side of the roll, samples shall be collected at the 10, 30, 50, 70, and 90 percent positions across the roll width. Both sides shall be tested for double sided geocomposites.

2.3 GEOMEMBRANE

2.3.1 Raw Materials

Resin used in manufacturing geomembrane sheets shall be made of virgin uncontaminated ingredients. No more than 10 percent regrind, reworked, or trim material in the form of chips or edge strips shall be used to manufacture the geomembrane sheets. All regrind, reworked, or trim materials shall be from the same manufacturer and exactly the same formulation as the geomembrane sheet being produced. No post consumer materials or water-soluble ingredients shall be used to produce the geomembrane. For geomembranes with plasticizers, only primary plasticizers that are resistant to migration shall be used. The Contractor shall submit a copy of the test reports and QC certificates for materials used in the manufacturing of the geomembrane shipped to the site.

2.3.2 Sheet Materials

Geomembrane sheets shall be uniform in color, thickness, and surface texture. Geomembrane sheets shall be textured on the upper face. The textured surface features shall consist of raw materials identical to that of the parent sheet material and shall be uniform over the entire face of the geomembrane. The sheets shall be free of and resistant to fungal or bacterial attack and free of cuts, abrasions, holes, blisters, contaminants and other imperfections. Geomembrane sheets and factory seams shall conform to the requirements listed in Table 3 and 4 for Manufacturing Quality Control (MQC).

TABLE 3. TEXTURED HDPE GEOMEMBRANE PROPERTIES

PROPERTY Nominal Thickness Minimum Thickness	TEST VALUE 40 mils 36 mils	TEST METHOD
Density (min)	0.940 g/cc	ASTM D 1505
Tensile Properties -yield stress -break stress -yield elongation -break elongation		ASTM D 638 Type IV
Tear Resistance	33 lb	ASTM D 1004
Puncture Resistance	60 lb	ASTM D 4833
Carbon Black Content	2.0-3.0 %	ASTM D 1603 (3)
Asperity Height (min ave)(4)	10 mils	GSI GRI GM12

Note (1): Minimum average machine direction and minimum average cross machine direction values shall be based on 5 test specimens in each direction. For HDPE geomembrane, yield elongation is calculated using a gauge length of 1.3 inches. For HDPE geomembrane, break elongation is calculated using a gauge length of 2.0 inches. For LLDPE geomembrane, break elongation is

calculated using a gage length of 2.0 inches at 2 inches/min.

Note (2): For HDPE geomembrane, the yield stress used to calculate the applied load for test method ASTM D 5397 (Appendix), shall be the manufacturer's mean value. ASTM D 5397 does not need to be run on LLDPE geomembrane.

Note (3): Other methods such as ASTM D 4218 or microwave methods are acceptable if an appropriate correlation to ASTM D 1603 can be established.

Note (4): Textured Geomembrane Only: Of 10 readings; 8 out of 10 must be 7 mil, and lowest individual reading must be 5 mil.

TABLE 4. HDPE SEAM PROPERTIES

PROPERTY	TEST VALUE	TEST METHOD
Seam Shear Strength (min)	80 lb/in	ASTM D 6392
Seam Peel Strength (min)	60 lb/in	ASTM D 6392

Note (1): Seam tests for peel and shear must fail in the Film Tear Bond mode. This is a failure in the ductile mode of one of the bonded sheets by tearing or breaking prior to complete separation of the bonded area.

Note (2): Where applicable, both tracks of a double hot wedge seam shall be tested for peel adhesion.

2.4 INTERFACE FRICTION TESTING

Laboratory interface friction tests shall be conducted on the following interfaces:

Geosynthetic Drainage Layer vs. Geotextile Geotextile vs. VSL Soil

2.4.1 Geosynthetic Drainage Layer vs. Geotextile

Tests shall be conducted in accordance with ASTM D 5321. Normal stresses of 190 psf, 237.5 psf, and 297 psf along with a displacement rate of 0.04 inches per minute shall be used. Interfaces tested shall be wet. Geosynthetics shall be the same materials as those proposed for use during full scale construction. Geosynthetics shall be oriented such that the shear force is parallel to the down slope orientation of these components in the field. A minimum peak interface friction angle of 20.5 degrees is required for the interface.

If the contractor uses a geocomposite drainage material with geotextile heat bonded to the geonet, the manufacturer's certification of the shear strength of the bond may be substituted for this test.

2.4.2 Geotextile vs. VSL Soil

Tests shall be conducted in accordance with ASTM D 5321. Normal stresses of 190 psf, 237.5 psf, and 297 psf along with a displacement rate of 0.005 inches per minute shall be used. Interfaces tested shall be wet. Soil components shall be the same as used for full scale construction and shall be compacted to the same moisture-density requirements specified for full scale field placement. The substrate behind the geotextile shall be a

sample of the geosynthetic drainage layer. The geonet shall be oriented with the side marked "top side" facing the geotextile, and such that the direction of movement, if any, of the geotextile relative to the geonet shall be from the upslope end of the geonet towards the downslope end. Geosynthetics shall be the same materials as those proposed for use during full scale construction. Geosynthetics shall be oriented such that the shear force is parallel to the down slope orientation of these components in the field. A minimum peak interface friction angle of 20.5 degrees is required for all interfaces.

PART 3 EXECUTION

3.1 GEOTEXTILE

3.1.1 Geotextile Samples

The Contractor shall provide quality assurance samples to an Independent Laboratory. Samples will be tested to verify that geotextile meets the requirements specified in Table 1. Test method ASTM D 4355 shall not be performed on the collected samples. Geotextile product acceptance shall be based on ASTM D 4759. Tests not meeting the specified requirements shall result in the rejection of applicable rolls.

The QC laboratory shall be accredited via the Geosynthetic Accreditation Institute's Laboratory Accreditation Program (GAI-LAP) for the tests the QC laboratory will be required to perform.

3.1.2 Placement

The Contractor shall notify the Owner's Representative a minimum of 24 hours prior to installation of geotextile. Geotextile rolls which are damaged or contain imperfections shall be repaired or replaced as directed. The geotextile shall be laid flat and smooth so that it is in direct contact with the subgrade. The geotextile shall also be free of tensile stresses, folds, and wrinkles. On slopes steeper than 10 horizontal on 1 vertical, the geotextile shall be laid with the machine direction of the fabric parallel to the slope direction.

3.1.3 Seams and Overlaps

Geotextile panels shall be continuously overlapped a minimum of 12 inches at all longitudinal and and a minimum of 36 inches at all transverse joints. Where seams must be oriented across the slope, the upper panel shall be lapped over the lower panel. If approved, sewn seams may be used instead of overlapped seams.

3.1.4 Protection

The geotextile shall be protected during installation from clogging, tears, and other damage. Damaged geotextile shall be repaired or replaced as directed. Adequate ballast (e.g. sand bags) shall be used to prevent uplift by wind. The geotextile shall not be left uncovered for more than 14 days after installation.

3.1.5 Repairs

Torn or damaged geotextile shall be repaired. Clogged areas of geotextile shall be removed. Repairs shall be performed by placing a patch of the same type of geotextile over the damaged area. The patch shall extend a

minimum of 18 inches beyond the edge of the damaged area. Patches shall be continuously fastened using approved methods. The machine direction of the patch shall be aligned with the machine direction of the geotextile being repaired. Geotextile which cannot be repaired shall be removed and replaced. Repairs to geotextile damaged by Contractor activities shall be performed at the Contractor's expense.

3.1.6 Acceptance

Geotextile shall not be covered with VSL soil prior to inspection and approval of the geotextile by the Owner's Representative.

3.2 GEOSYNTHETIC DRAINAGE LAYER

3.2.1 Geosynthetic Drainage Layer Samples

The Contractor shall provide quality assurance samples of geonet to an Independent Laboratory. Samples will be tested to verify that geonet meets the requirements specified in Table 2. Tests not meeting the specified requirements shall result in the rejection of applicable rolls.

The QC laboratory shall be accredited via the Geosynthetic Accreditation Institute's Laboratory Accreditation Program (GAI-LAP) for the tests the QC laboratory will be required to perform.

3.2.2 Placement

The geosynthetic drainage layer shall be unrolled in the direction of maximum slope, keeping the geonet flat against the subgrade to minimize wrinkles and folds. The geosynthetic drainage layer shall not be dragged across textured geomembrane. Adequate ballast (e.g. sandbags) shall be placed to hold the geosynthetic drainage layer in place. No equipment shall be operated on the top surface of the geosynthetic drainage layer. The geosynthetic drainage layer shall be covered with geotextile within 14 days of acceptance.

3.2.3 Seams and Overlaps

3.2.3.1 Geonet Side Seams

Geonet side seams shall be overlapped a minimum of 4 inches or as recommended by the manufacturer, whichever is greater. Side seam fastener spacing shall be a maximum of 5 feet or as recommended by the manufacturer, whichever is greater.

3.2.3.2 Geonet End Seams

Geonet end seams shall be overlapped a minimum of 1 foot or as recommended by the manufacturer, whichever is greater. End seam fastener spacing shall be a maximum of 1 foot or as recommended by the manufacturer, whichever is greater. The overlaps shall be in the direction of flow.

3.2.3.3 Geonet Fasteners

Geonet rolls shall be tied together with plastic fasteners. The fasteners shall be a contrasting color from the geonet and attached geotextiles. Metallic fasteners will not be allowed.

3.2.3.4 Geotextile Seams

The geotextile component of the geocomposite shall be overlapped in the direction of flow.

3.2.4 Repairs

3.2.4.1 Geonet Damage

Repairs shall be made by placing a patch of the geonet over the damaged area. The patch shall extend a minimum of 2 feet beyond the edge of the damage. Approved fasteners, spaced every 6 inches around the patch, shall be used to hold the patch in place. If more than 25 percent of the roll width is damaged, repair approval must be obtained from the Owner's Representative or else the Contractor shall replace the damaged roll.

3.2.4.2 Geotextile Damage

Damaged geotextile which forms part of a geocomposite drainage layer shall be repaired by placing a patch of geocomposite over the damaged area with a minimum of 18 inches of overlap in all directions. The geocomposite patch shall be held in place with approved fasteners, spaced every 6 inches around the patch.

3.2.5 Acceptance

Geosynthetic drainage layer shall not be covered with geotextile prior to inspection and approval of the geosynthetic drainage layer by the Owner's Representative.

3.3 GEOMEMBRANE

3.3.1 Weather Limitations

Geomembrane shall not be deployed or field-seamed in the presence of excess moisture (i.e., rain, fog, dew), in areas of ponded water, or in the presence of excess wind. No placement or seaming shall be attempted at ambient temperatures below 32 degrees F or above 104 degrees F. In marginal conditions, seaming shall cease unless destructive field seam tests, confirm that seam properties meet the requirements listed in Table 4. Tests shall be conducted in accordance with paragraph Destructive Field Seam Strength Testing.

3.3.2 Surface Preparation

Rocks larger than 1/2 inch in diameter and any other material which could damage the geomembrane shall be removed from the surface to be covered with the geomembrane. Construction equipment tire or track deformations beneath the geomembrane shall not be greater than 1.0 inch in depth. Each day during placement of geomembrane, the Owner's Representative and the Contractor shall inspect the surface on which geomembrane is to be placed. The Contractor shall not place geomembrane until the subgrade has been approved by the Owner's Representative.

3.3.3 Placement

The procedures and equipment used shall not elongate, wrinkle, scratch, or otherwise damage the geomembrane, other geosynthetic layers, or the underlying subgrade. Geomembrane damaged during installation shall be

replaced or repaired, at the Owner's Representative's discretion. Only geomembrane panels that can be anchored and seamed together the same day shall be deployed. Adequate ballast (i.e., sand bags) shall be placed on the geomembrane, without damaging the geomembrane, to prevent uplift by wind. The methods used to deploy and backfill over the geomembrane shall minimize wrinkles and tensile stresses in the geomembrane. The geomembrane shall have adequate slack to prevent the creation of tensile stress. The wrinkle height to width ratio for installed geomembrane shall not exceed 0.5. In addition, geomembrane wrinkles shall not exceed 6 inches in height. Wrinkles that do not meet the above criteria shall be cut out and repaired in accordance with the installer's approved QC procedures.

3.3.4 Field Seaming

3.3.4.1 Geomembrane Trial Seam Testing

Trial seams shall be made under field conditions on strips of excess geomembrane. Trial seams shall be made each day prior to production seaming, whenever there is a change in seaming personnel or seaming equipment and at least once every four hours, by each seamer and each piece of seaming equipment used that day. Trial seam samples shall be collected and tested in accordance with ASTM D 6392. One sample shall be obtained from each trial seam. This sample shall be at least 36 inches long by 12 inches wide with the seam centered lengthwise. Ten random specimens 1 inch wide shall be cut from the sample. Five seam specimens shall be field tested for shear strength and 5 seam specimens shall be field tested for peel adhesion using an approved quantitative tensiometer. To be acceptable, 4 out of 5 replicate test specimens shall meet seam strength requirements specified in Table 4. If the field tests fail to meet these requirements, the entire operation shall be repeated. If the additional trial seam fails, the seaming apparatus or seamer shall not be used until the deficiencies are corrected by the installer and 2 consecutive successful trial seams are achieved.

3.3.4.2 Field Seams

Panels shall be seamed in accordance with the geomembrane manufacturer's recommendations. In corners and odd-shaped geometric locations, the number of field seams shall be minimized. Seaming shall extend to the outside edge of panels. Soft subgrades shall be compacted and approved prior to seaming. The seam area shall be free of moisture, dust, dirt, and foreign material at the time of seaming. Fish mouths in seams shall be repaired.

Polyethylene geomembranes shall be seamed by thermal fusion methods where feasible. Extrusion welding shall only be used for patching and seaming in locations where thermal fusion methods are not feasible. Seam overlaps that are to be attached using extrusion welds shall be ground prior to welding. Grinding marks shall be oriented perpendicular to the seam direction and no marks shall extend beyond the extrudate after placement. Extrusion welding shall begin within 10 minutes after grinding. Where extrusion welds are temporarily terminated long enough to cool, they shall be ground prior to applying new extrudate over the existing seam. The total depth of the grinding marks shall be no greater than 10 percent of the sheet thickness.

3.3.5 Geomembrane Samples

One QC sample, 18 inches in length, for the entire width of a roll, shall be obtained for every 100,000 square feet of material delivered to the

site. Samples shall not be obtained from the first three feet of the roll. The samples shall be identified by manufacturer's name, product identification, lot and roll/panel number. The date, a unique sample number, and the machine direction shall also be noted. In addition, a 24 inch by 24 inch QA sample shall be collected, labeled, and submitted to the Owner's Representative each time QC samples are collected.

3.3.6 Geomembrane Tests

3.3.6.1 Geomembrane Laboratory Testing

The Contractor shall provide all QC samples to the QC laboratory to determine density, thickness, tensile strength at break, and elongation at break in accordance with the methods specified in Table 3. Samples not meeting the specified requirements shall result in the rejection of applicable rolls/panels. As a minimum, rolls/panels produced immediately prior to and immediately after the failed roll/panel shall be tested for the same failed parameter. Testing shall continue until a minimum of three successive rolls/panels on both sides of the original failing roll/panel pass the failed parameter.

The QC laboratory shall be accredited via the Geosynthetic Accreditation Institute's Laboratory Accreditation Program (GAI-LAP) for the tests the QC laboratory will be required to perform.

3.3.6.2 Non-Destructive Field Seam Continuity Testing

Field seams shall be non-destructively tested for continuity over their full length in accordance with the installer's approved QC manual. Seam testing shall be performed as the seaming work progresses, not at the completion of field seaming. Any seams which fail shall be documented and repaired in accordance with the installer's approved QC manual.

3.3.6.3 Destructive Field Seam Strength Testing

A minimum of one destructive test sample per 500 feet of field seam shall be obtained at locations specified by the Owner's Representative. Sample locations shall not be identified prior to seaming. Samples shall be a minimum of 12 inches wide by 42 inches long with the seam centered lengthwise. Each sample shall be cut into 3 equal pieces, with one piece retained by the installer, one piece given to the QC laboratory, and the remaining piece given to the Owner's Representative for QA testing and/or permanent record. Each sample shall be numbered and cross referenced to a field log which identifies: (1) panel number; (2) seam number; (3) date and time cut; (4) ambient temperature within 6 inches above the geomembrane; (5) seaming unit designation; (6) name of seamer; and (7) seaming apparatus temperature and pressures (where applicable). Ten 1 inch wide replicate specimens shall be cut from the installer's sample. Five specimens shall be tested for shear strength and 5 for peel adhesion using an approved field quantitative tensiometer. To be acceptable, 4 out of 5 replicate test specimens shall meet the seam strength requirements specified in Table 4. If the field tests pass, 5 specimens shall be tested at the QC laboratory for shear strength and 5 for peel adhesion in accordance with the QC laboratory's approved procedures. To be acceptable, 4 out of 5 replicate test specimens shall meet the seam strength requirements specified in Table 4. If the field or laboratory tests fail, the seam shall be repaired in accordance with paragraph Destructive Seam Test Repairs. Holes for destructive seam samples shall be repaired the same day they are cut.

3.3.7 Defects and Repairs

3.3.7.1 Destructive Seam Test Repairs

Seams that fail destructive seam testing may be overlaid with a strip of new material and seamed (cap stripped). Alternatively, the seaming path shall be retraced to an intermediate location a minimum of 10 feet on each side of the failed seam location. At each location a 12 by 18 inch minimum size seam sample shall be taken for 2 additional shear strength and 2 additional peel adhesion tests using an approved quantitative field tensiometer. If these tests pass, then the remaining seam sample portion shall be sent to the QC laboratory for 5 shear strength and 5 peel adhesion tests in accordance with the QC laboratory's approved procedures. To be acceptable, 4 out of 5 replicate test specimens must meet specified seam strength requirements. If these laboratory tests pass, then the seam shall be cap stripped or repaired using other approved methods between that location and the original failed location. If field or laboratory tests fail, the process shall be repeated. After repairs are completed, the repaired seam shall be non-destructively tested in accordance with paragraph Non-Destructive Field Seam Continuity Testing.

3.3.7.2 Patches

Tears, holes, blisters and other defects shall be repaired with patches. Patches shall have rounded corners, be made of the same geomembrane, and extend a minimum of 6 inches beyond the edge of defects. Minor localized flaws shall be repaired by spot welding or seaming as determined by the QC inspector. Repairs shall be non-destructively tested. The Owner's Representative or the QC inspector may also elect to perform destructive seam tests on suspect areas.

3.3.8 Visual Inspection and Evaluation

Immediately prior to covering, the geomembrane, seams, and non-seam areas shall be visually inspected by the QC inspector and Owner's Representative for defects, holes, or damage due to weather conditions or construction activities. At the Owner's Representative's or the QC inspector's discretion, the surface of the geomembrane shall be brushed, blown, or washed by the installer if the amount of dust, mud, or foreign material inhibits inspection or functioning of the overlying material. Each suspect location shall be non-destructively tested in accordance with paragraph Non-Destructive Field Seam Continuity Testing. Each location that fails non-destructive testing shall be repaired in accordance with paragraph Patches and non-destructively retested.

3.3.9 Protection and Backfilling

The deployed and seamed geomembrane shall be covered with the specified material within 14 calendar days of acceptance. Wrinkles in the geomembrane shall be prevented from folding over during placement of cover materials.

3.3.10 Geomembrane As-Built Drawings

Final as-built drawings of the geomembrane installation shall be prepared. These drawings shall include panel numbers, seam numbers, location of repairs, destructive seam samples, and penetrations.

-- End of Section --

SECTION 31 10 00

CLEARING FOR CIVIL WORKS 04/06

PART 1 GENERAL

1.1 AUTHORIZATION FOR CLEARING

All ground areas requiring clearing for site access shall be approved by the Owner's Representative prior to the commencement of clearing activities.

All construction roads for access to the work area shall be approved by the Owner's Representative, as to location and alignment, prior to construction.

1.1.1 EXISTING CONDITIONS

PART 2 PRODUCTS

All logs, cordwood, wood chips, mulch, other marketable timber products, and all waste products shall become the property of the Contractor.

PART 3 EXECUTION

3.1 REMOVAL OF FENCES

Fence sections along the toe of the CMSD landfill slope which have been dislocated by the sliding soil mass shall be temporarily removed.

Fence sections may be removed to permit or enhance site access with the approval of Ormet's Representative.

All fence materials removed, if reusable, shall be stored in a location and manner to prevent damage. All fences removed shall be replaced at the end of construction.

3.2 CLEARING BRUSH AND TREES

The Contractor shall cut brush and trees only in areas and to the extent authorized by the Owner's Representative.

A tree chipper may be used at the option of the Contractor in all clearing operations.

All material cleared shall be completely removed by transporting from the property. In no case shall cleared material be thrown into or left in the river. No burning of brush or trees shall be allowed on site.

3.3 REMOVAL OF TEMPORARY SLOPE PROTECTION

The main failure area of the CNMSD landfill slope is protected against rainwater infiltration by temporary plastic sheeting. The Contractor shall remove the temporary plastic sheeting as slope reconstruction progresses.

The temporary plastic sheeting shall remain in place until the day the contractor is ready to reconstruct the multilayer cap. The temporary plastic sheeting must remain in place during periods of precipitation.

The Contractor shall replace the temporary plastic sheeting at the end of each working day over all slope areas with less than two accepted lifts of VSL soil in place. The temporary plastic sheeting shall be anchored in place with sandbags or rocks to prevent uplift from the wind. The soil beneath the lower end of the temporary plastic sheeting shall be contoured to provide an outlet for any water which may accumulate on the temporary plastic sheeting.

The Contactor shall dispose of the temporary plastic sheeting when it is no longer required for slope protection.

3.4 EROSION PROTECTION

All ground areas which are disturbed by clearing operations and which would become subject to erosion will be protected from erosion during the Project execution.

-- End of Section --

SECTION 31 25 13

EROSION AND SEDIMENTATION CONTROLS

10/06

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

The work consists of furnishing and installing soil surface erosion control materials to prevent the pollution of air, water, and land, including fine grading, blanketing, stapling, mulching, vegetative measures, structural measures, or other miscellaneous related work, within project limits and in areas outside the project limits where the soil surface is disturbed from work under this contract at the designated locations. This work includes all necessary materials, labor, supervision and equipment for installation maintenance of a complete system, and removal of temporary system components at the completion of the Project.

PART 2 PRODUCTS

The Contractor shall select any and all products and materials for erosion control. Products may include, but are not necesssarily limited to, soil binders, mulch, straw, hay, wood cellulose fiber, paper fiber, shredded bark, wood by-products, mulch control netting, hydraulic mulch and tackifier, geotextile fabrics, erosion control blankets, silt fencing, or aggregate.

PART 3 EXECUTION

The Contractor shall be responsible for selecting, installing, and maintaining erosion and sediment control measures. Erosion control measure locations may be adjusted to meet field conditions. All erosion damage in reconstructed CMSD landfill cap areas, elsewhere within Project limits, or areas outside the project limits shall be repaired at the Contractor's expense to the satisfaction of the Owner's Representative.

-- End of Section --

SECTION 32 00 00

EXTERIOR IMPROVEMENTS 10/06

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. DEPARTMENT OF AGRICULTURE (USDA)

AMS Seed Act

(1940; R 1988; R 1998) Federal Seed Act

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-06 Test Reports

SD-07 Certificates

Seed Certification

PART 2 PRODUCTS

2.1 SEED

2.1.1 Grass Seed

Provide seed of the latest season's crop delivered in original sealed packages, bearing producer's guaranteed analysis for percentages of mixtures, purity, germination, weedseed content, and inert material. Label in conformance with AMS Seed Act and applicable state seed laws. Wet, moldy, or otherwise damaged seed will be rejected.

Furnish grass seed from a grass seed dealer or grower whose brands are grades registered or licensed by the State of Ohio, Department of Agriculture or from the approved list of grass seed dealers or growers on file with Department. Furnish the kind and type of grass seed required that meets the minimum percentage germination rates specified below.

TABLE 1
Germination Rates

Species	Minimum Percent
Kentucky Bluegrass	80
Fine Fescue	85
Perennial Ryegrass	85
Annual Ryegrass	85
Tall Fescue	85

TABLE 1 Germination Rates

Species	Minimum
	Percent
Creeping Red Fescue	85

Mark the test date on seed bags. Furnish seeds as separate species and cultivars, packaged together or bagged separately, and properly labeled, tagged, or marked. Sow seeds within 9 months of the testing date.

Submit a written Seed Certification for the seed. Include the following with the description:

- A. Name and location of the seed supplier.
- B. Origin and date of harvest of each kind of seed.
- C. A statement of the purity and germination of each seed.
- D. Testing date for each seed.

2.1.2 Crown Vetch

Inoculate or treat all crown vetch seeds with the proper amount of pure nitrogen-fixing bacteria and mix with sufficient water to thoroughly wet the seed. The bacteria selected will be for maximum vitality and shall not be more than one-year old. All culture records will be provided with the leguminous seeds.

If sown hydraulically, use 4 times the inoculant rate specified by the inoculant manufacturer. If pre-inoculated seed is used then use 3 times the inoculant rate specified by the inoculant manufacturer. Immediately before seeding, add inoculant and sticking agent directly into the slurry, and thoroughly mix the slurry. Sow seed as soon as possible after inoculation. If left standing for more than 24 hours, reinoculate seed before sowing. Mix all seed on the project.

Submit a written Seed Certification for the seed. Include the following with the description:

- A. Name and location of the seed supplier.
- B. Origin and date of harvest of each kind of seed.
- C. A statement of the purity and germination of each seed.
- D. Testing date for each seed.

2.2 SOIL CONDITIONERS, MULCH, AND WATER

The Contractor shall furnish and apply soil conditioners, mulch, and water as necessary to improve the germination and establishment of the vegetative cover of grass and crown vetch. The types, application rates, and application methods are the responsibility of the Contractor. Areas which fail to develop vegetation shall be reseeded at the Contractor's sole expense.

PART 3 EXECUTION

3.1 SEEDING

3.1.1 Extent of Work

Provide soil preparation (including soil conditioners as required), fertilizing, seeding, and surface topdressing of all newly graded finished earth surfaces, unless indicated otherwise, and at all areas inside or outside the limits of construction that are disturbed by the Contractor's operations and designated for seeding by the Owner's Representative.

3.1.2 Seed Protection

Protect from drying out and from contamination during delivery, on-site storage, and handling. Store in cool, dry locations away from contaminants.

3.1.3 Seed Application Seasons and Conditions

Do not seed when ground is muddy, frozen, snow covered, or in an unsatisfactory condition for seeding. Apply seed within twenty four hours after seedbed preparation. Sow seed by approved sowing equipment. Sow one-half the seed in one direction, and sow remainder at right angles to the first sowing.

3.1.4 Seed Application Method

Seeding method shall be broadcasted and drop seeding, drill seeding, or hydroseeding.

3.1.5 Minimum Coverage and Reseeding

The Owner's Representative will inspect all seeded areas no earlier than 6 months and no later than 12 months after final seeding. For any area identified without a uniform density of at least 70 percent grass cover or established crown vetch, the Contractor will reseed at no cost to Ormet.

3.1.6 Erosion Control Material

Install in accordance with manufacturer's instructions, where indicated or as directed by the Contracting Officer.

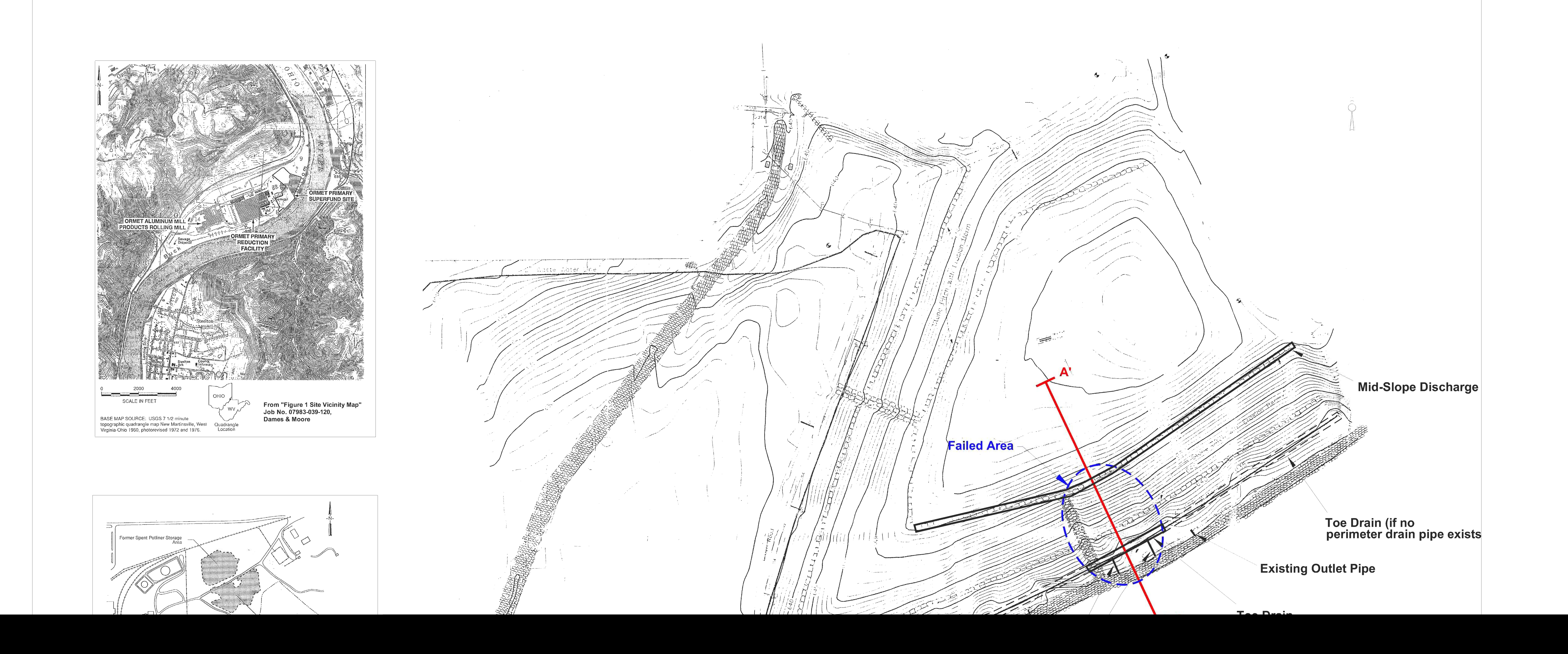
3.2 SITE RESTORATION AND DEMOBILIZATION

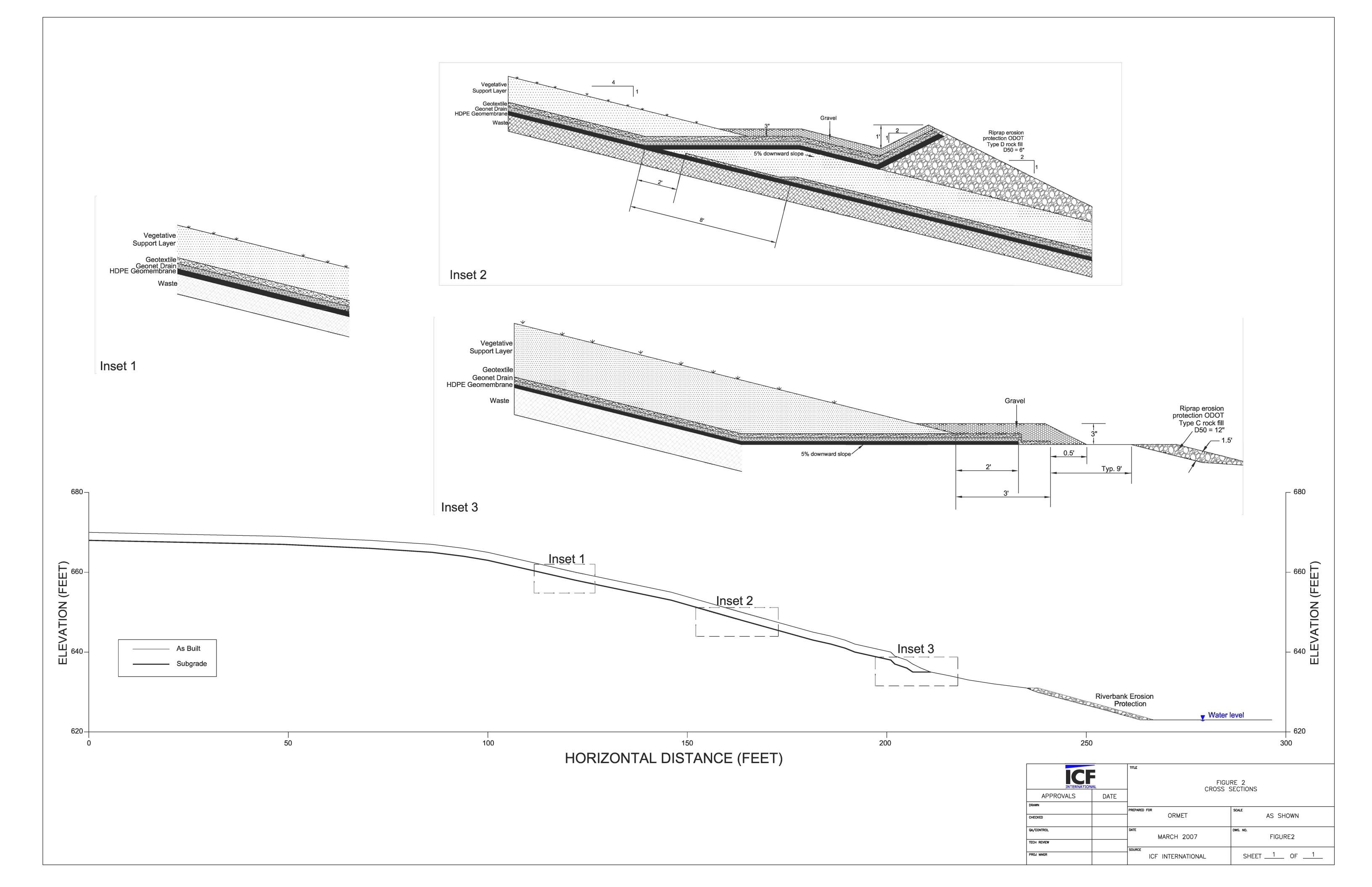
The Contractor shall remove all temporary construction signs and fencing, remove all temporary erosion control measures, remove any temporary facilities or structures, remove all equipment, reconstruct permanent fencing, restore disturbed areas, and perform final site cleanup.

The Contractor shall reinstall any portions of the chain link fence along the toe of the CMSD landfill slope removed during the Project. If serviceable, the original fencing and poles may be reinstalled.

The Contractor shall regrade and reseed any areas disturbed by movement of construction equipment or other construction activities to the satisfacton of the Owner's Representative.

-- End of Section --





Appendix C

Ormet Primary Aluminum Corporation

CMSD Landfill Cap Repair

Material Property, Testing, and As Built Submittals

- 1. Manufacturer's Specifications, geonet, Transnet 200, Engineered Synthetic Products
- 2. Manufacturer's Specifications, geonet, Transnet 220, Engineered Synthetic Products
- 3. Manufacturer's Specifications, geonet, Transnet 220, SKAPS Industries
- 4. Manufacturer's Specifications, geotextile, Mirafi S800, TenCate (fax)
- 5. Manufacturer's Specifications, geotextile, Mirafi S800, TenCate (web)
- 6. Kemron Geomembrane and Geocomposite Material Submittal, 20 August 2007
- 7. Manufacturer's Specifications, geonet, 200 mil, Agru America
- 8. Manufacturer's Specifications, geomembrane, HDPE Micro Spike, Agru America
- 9. Manufacturer's Specifications, geomembrane, GSE HDPE textured (fax)
- 10. Manufacturer's Specifications, geomembrane, GSE HDPE textured (web)
- 11. Kemron Ormet Geotechnical Testing Submittal, 31 July 2007
- 12. Kemron Borrow Source Certification, 24 October 2007 (analytical results only)
- 13. Kemron Density Testing Results, 22 August 2007
- 14. Kemron Density Testing Results, 18 September 2007 and 21 September 2007
- 15. Kemron Stone Sieve Analysis, 24 August 2007
- 16. Geomembrane Seam Testing Results, 17 August 2007
- 17. Kemron Geomembrane Welding Samples, 11 September 2007
- 18. Kemron Friction Testing Result for the Geonet and Geotextile Materials, 20 August 2007 (geonet vs. geotextile)
- 19. Kemron Friction Angle Laboratory Testing Results, 30 August 2007 (VSL vs. geotextile)
- 20. Kemron Interface Testing Results, 22 August 2007 (VSL vs. geocomposite)
- 21. Kemron As Built Drawing
- 22. Kemron Midslope Diversion Berm, Downchute, and Fence Post Details
- 23. ICF Memorandum, Kemron Submittals Geosynthetic Manufacturers' Product Specifications, 6 August 2007
- 24. ICF Memorandum, Kemron Submittals Geosynthetic Manufacturers' Product Specifications, 21 August 2007
- 25. ICF Memorandum, Kemron Submittals Aggregate, 24 August 2007
- 26. ICF Memorandum, Geomembrane Seam Acceptance, 18 September 2007



GEONET

ENGINEERED SYNTHETIC PRODUCTS, INC.

405 Hood Road Lilburn CA 30047 Phone (770)564-1857

DRAINAGE PRODUCT DESCRIPTION SILEST

THANSNET 140

Transper 200 is a superior quality drainage media made by extruding two sets of HDPE sureris together in frem a diamond shaped net. This three dimensional structure provides or collect please liquid flow. SKAPS geometr are manufactured from first quality virgin resin geometrs and a full range of nonwoven geometries. The Transper 100 conforms to the physical property values listed fights:

net property	TEST METHOD	UNITS	MINIMIM AVERAGE ROLL VALUE
Micos Per Unit Area	ASTM D-5361	ibur ⁱ	0.162
Thickness	ASTM D-5199	jaches	200
Density of Polymer	ASTM U-1505	g/ork ³	0.94
Uarbon Black	ASTM D-1603	%	2-3
Transmissivity	ASTM D-4716	ni ^z is	£ × 10 ⁻³ e
Tensilo Strongth	ASTM D-5075	the Fine.	45
Molt Index	ASTM D-1238	e/10 min	t max

^{*}Transmissivity of the geomet measured using water at 20 Degrees C with a gradient of 1, between steel plates, under a contining pressure of 15,000 per, after 1 hour. Values may vary based on dimension of the transmissivity specimen and specific laboratory.

TOTAL P.01







SKAPS Transnet geocomposites typically consist of SKAPS GeoNet made from HDPE resin. SKAPS Transnet is designed specifically for use in situations where high normal loads are expected, such as in landfill design.

SKAPS TRANSNET (TN)

HDPE Geonet

TN 220

TESTED PROPERTY	TEST METHOD	MINIMUM AVERAGE VALUES ¹
Net Properties		
Polymer Density, g/cm ²	ASTM D 1505	0.94
Carbon Black Content, %	ASTM D 1603	2.0
Thickness, mil	ASTM D 5199	200
Mass per Unit Area, lbs./ft ²	ASTM D 5261	0.162
Tensile Strength, lbs./in.	ASTM D 5035	50
Transmissivisity ² , m ² /sec	ASTM D 4716	1x10 ⁻³

- 1. These values represent minimum acceptable test values for an individual roll as tested according to SKAPS Manufacturing Quality Control Manual. Individual test specimen may vary.
- 2. Transmissivity measured using water at 20° C at a gradient of 0.1, under confining pressure of 10,000 psf, between stainless steel plates. Values may vary between individual laboratories.

This information is provided for reference purposes only and is not intended as a warranty or guarantee. SKAPS assumes no liability in connection with the use of this information. Check with SKAPS for current, standard minimum quality assurance procedures.



SKAPS Industries 571 Industrial Parkway Commerce, GA 30529 (U.S.A.) Phone (706) 336-7000 Fax (706) 336-7007

e-mail: info@skaps.com

SKAPS TRANSNET™ (TN) HDPE GEONET 220

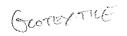
SKAPS TRANSNET™ geonet consists of SKAPS GeoNet made from HDPE resin.

Property	Test Method	Unit	Required Value	Qualifier
Geonet				
Mass per Unit Area	ASTM D 5261	lb/ft ²	0.17	Minimum
Thickness	ASTM D 5199	mil.	220±20	Range
Carbon Black	ASTM D 4218	%	2 to 3	Range
Tensile Strength	ASTM D 5035	lb/in	45	Minimum
Melt Flow	ASTM D 1238 ³	g/10 min.	1	Maximum
Density	ASTM D 1505	g/cm ³	0.94	Minimum
Transmissivity ¹	ASTM D 4716	m²/sec.	1x10 ⁻³	$MARV^2$

Notes:

- 1. Transmissivity measured using water at $21 \pm 2^{\circ}$ C ($70 \pm 4^{\circ}$ F) with a gradient of 1.0 and a confining pressure of 15000 psf between stainless steel plates after 15 minutes. Values may vary between individual labs.
- MARV is statistically defined as mean minus two standard deviations and it is the value which is exceeded by 97.5% of all the test data.
- 3. Condition 190/2.16

This information is provided for reference pruposes only and is not intended as a warranty or guarantee. SKAPS assumes no liability in connection with the use of this information.



%TENCATE MITATI





Mirafi® S800

Mirafi® S800 is a needle-punched nonwoven geotextile composed of polypropylene fibers, which are formed into a stable network such that the fibers retain their relative position. Mirafi® S800 is inert to biological degradation and resistant to naturally encountered chemicals, alkalis, and acids.

Mechanical Properties	Test Method	Unit	Minimum Average Roll Value
Weight	ASTM D 5261	g/m² (oz/yd²)	271 (8.0)
Thickness	ASTM D 5199	mm (mils)	2.29 (90)
Grab Tensile Strength	ASTM D 4632	kN (lbs)	1.02 (230)
Grab Tensile Elongation	ASTM D 4632	%	50
Trapezoid Tear Strength	ASTM D 4533	kŅ (lbs)	0.38 (85)
Mullen Burst Strength	ASTM D 3786	kPa (psi)	2753 (400)
Puncture Strength ¹	ASTM D 4833	kŅ (lbs)	0.58 (130)
CBR Puncture Strength	ASTM D 6241	kN (lbs)	2.7 (600)
Apparent Opening Size (AOS)	ASTM D 4751	mm (U.S. Sieve)	0.150 (100)
Permittivity	A\$TM D 4491	sec	1.36
Permeability	ASTM D 4491	cm/sec	0.31
Flow Rate	ASTM D 4491	l/min/m² (gal/min/ft²)	4073 (100)
UV Resistance (at 500 hours)	ASTM D 4355	% strength retained	80

ASTM D 4833 has been replaced with ASTM D 6241

Physical Properties		
Roll Dimensions (width x length)	m (ft)	4.5 x 91 (15 x 300)
Roll Area	m² (yd²)	418 (500)
Estimated Roll Weight	kg (lb)	130 (286)

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materials that make a difference

FG\$000348 ETQR1







Mirafi[®] S800

Mirafi[®] S800 is a needle-punched nonwoven geotextile composed of polypropylene fibers, which are formed into a stable network such that the fibers retain their relative position. Mirafi[®] S800 is inert to biological degradation and resistant to naturally encountered chemicals, alkalis, and acids.

Mechanical Properties	Test Method	Unit	Minimum Average Roll Value
Weight	ASTM D 5261	g/m² (oz/yd²)	271 (8.0)
Thickness	ASTM D 5199	mm (mils)	2.29 (90)
Grab Tensile Strength	ASTM D 4632	kN (lbs)	1.02 (230)
Grab Tensile Elongation	ASTM D 4632	%	50
Trapezoid Tear Strength	ASTM D 4533	kN (lbs)	0.38 (85)
Mullen Burst Strength	ASTM D 3786	kPa (psi)	2753 (400)
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CBR Puncture Strength	ASTM D 6241	kN (lbs)	2.7 (600)
Apparent Opening Size (AOS)	ASTM D 4751	mm (U.S. Sieve)	0.150 (100)
Permittivity	ASTM D 4491	sec ⁻¹	1.36
Permeability	ASTM D 4491	cm/sec	0.31
Flow Rate	ASTM D 4491	l/min/m ² (gal/min/ft ²)	4073 (100)
UV Resistance (at 500 hours)	ASTM D 4355	% strength retained	80

¹ ASTM D 4833 has been replaced with ASTM D 6241

Physical Properties	Unit	Typical Value
Roll Dimensions (width x length)	m (ft)	4.5 x 91 (15 x 300)
Roll Area	m² (yd²)	418 (500)
Estimated Roll Weight	kg (lb)	130 (286)

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materials that make a difference



1359-A Ellsworth Industrial Boulevard ■ Atlanta, GA 30318 ■ Telephone (404) 636-0928 ■ FAX (404) 636-7162 ■ http://www.kemron.com

August 20, 2007

Steven J. Reichenbacher **ICF International** (781) 676-4079 Tel (339) 206-9095 Cell (781) 676-4005 Fax

E-mail: sreichenbacher@icfi.com

Re: Geomembrane and Geocomposite Material Submittal

Upper Diversion Berm

Ormet CMSD Landfill Cap Repair

Dear Mr. Reichenbacher,

Please find attached the material submittal for the Geomembrane (HDPE) and the Geocomposite Drainage Net materials as delivered to the site for the installation of the upper diversion berm structure. The friction testing results will be provided under separate cover.

Please do not hesitate to call me at 404.242.5837 to discuss if you require any additional information for these materials.

Sincerely,

Michael Riley Senior Project Manager

Cc: Ralph Grismala, ICF John Mount, Kemron

microspike liner HDPE 40 mil	METRIC DIMENSIONS			AEG Kemron doc 9456 Hannibal, OH 1 roll 40 HD micro 4 rolls 6-200 composite		PO#	307042
roll #	width	length	area	·			
(P)319714 .07	7	182.9	1280	AMER ENV HANNIBAL, OH	3645		MM196125
515314 .07	14.5	250	3625	6-200 AEG Hannibal, OH	960		CTN610511
515522 .07	14.5	200	2900	6-200 AEG Hannibal, OH	730		CTN610511
515523 .07	14.5	200	2900	6-200 AEG Hannibal, OH	730		CTN610511
515524 .07	14.5	200	2900	6-200 AEG Hannibal, OH	736		CTN610511

6801



quality certificate

ROLL# 319714-0)7 Lot #:	MM196125	Liner Type: I	MICROSPIK	E™ HDP	E
/NA 115 1)	METRIC IIN: 0.98 mm		Thickness Length Width	1.0 mm 182.9 ^m 7.00 m;	40 mil 600.1 fe 23.0 fe	et et
	VE: 1.09 mm	43 mil	OIT(Standard) ASTM D3895	5 minutes 153	TEST RESUL	
Specific Gravity ASTM D792	Density		g/cc		.945	
MFI ASTM D1238 COND. E GRADE: 7002	Melt Flow Ind	lex 190°C /2160 g	g/10 min		.25	
Carbon Black Content ASTM D4218	Range		%		2.24	
Carbon Black Dispersion ASTM D5596	Category				1	
Tensile Strength ASTM D6693 ASTM D638 (Modified) (2 inches / minute)	Average Stre	ngth @ Yield	17 N/mm	100 ppi	2,325	psi
(2 mones / minute)	Average Stre	ngth @ Break	23 N/mm	131 ppi	3,057	psi
Elongation ASTM D6693 ASTM D638 (Modified) (2 inches / minute) Lo = 1.3" Yield	Average Elon	ngation @ Yield	%		19.24	
Lo = 2.0" Break	Average Elon	ngation @ Break	%		492.1	
Dimensional Stability ASTM D1204 (Modified)	Average Dime	ensional change	%		-0.54	
Tear Resistance ASTM D-1004 (Modified)	Average Tea	r Resistance	162.8 N		36.600	lbs
Puncture Resistance FTMS 101 Method 2065 (Mod	Load ified)		304.2 N		68.396	lbs
Puncture Resistance ASTM D4833 (Modified)	Load		428.0 N		96.219	lbs
ESCR ASTM D1693	Minimum Hr	s w/o Failures	1500 hrs	CI	ERTIFIED	
Notched Constant Tensile Loa ASTM D5397	pass / fail @ 3	30%	300 hrs		PASS	

Customer: American Environmental

PO: 307042 Kemrom Co Ormet

Destination Hannibal, OH

5-14-07

Signature.....Quality Control Department

40HDmic.FRM REV 02 12/23/05



Petromont and Company, Limited Partnership Petromont Inc., Sole General Partner 10455 Metropolitain East Montreal-East, QC, H1B 1A1 CANADA

Tel: 514-640-7400

http://www.petromont.qc.ca

Customer information

AGRU AMERICA 500 GARRISON RD GEORGETOWN SC 29440 USA

Contact

PALMER GRANT 843-546-0516

Your reference 4516

Your material number

Quality certificate

Repeat printout

Date

2007/02/23 13:14:19

Delivery item

PETROMONT HDPE-7002

Delivery number and item 80112157 000010 Order number and item

30304 000010

Vehicule

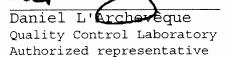
UNPX 123349

Material: PETROMONT HDPE-7002

Batch MM 196125 / Qty 85,100 KG 187,613 lb

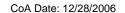
Characteristics	Unit	Value	Lower limit	Upper limit
Melt index 190C 2.16 kg Flow Index 190C 21.6kg Density Annealed 15C/min Pellet Count Oxydative Induction Time		0.250 26.1 0.9369 27 159	0.170 21.0 0.9365 20 100	27.0 0.9385 35

*** End ***





Cousting Start Anniolation County Start Anniolation Cou									1				
Septembrie Sep					Geonet Component	**Transmissivity Conditions:	0.1 gradient, 10,000 psf	15 minute seating time		-	2 .	3.	4 .
State Compose Compos				quality control dept.	Geocomposite	*Transmissivity Conditions:	0.1 gradient, 10,000 psf	15 minute seating time	Resin Lot#	CTN610511	CTN610511	CTN610511	CTN610511
September Sept					NET	ASTM	D4716	Trans**	m²/sec	3.94 E-3	6.65 E-3	6.65 E-3	6.65 E-3
September Sept		anager			NET	ASTM	D5261	M/U	lb/ft²	0.164	0.196	0.196	0.196
September Sept		Control Ma			NET	ASTM	D5035		lp/in	63.95	80.8	80.8	80.8
September Sept		Quality			NET	ASTM	D792	Den	g/cc	0.955	0.957	0.957	0.957
September Sept					NET	ASTM ,	04218		%	2.35	2.61		
COMP COMP COMP		a oad 29440 i00			NET	ASTM ,	D5199 [ave	Ē	207	220	220	220
COMP COMP COMP		u Americ arrison R own, SC 13-546-06			NET	ASTM	D5199	hi	Ē	219	232	232	232
COMP COMP COMP		Agr 500 Gs Georget ph: 8			RET	ASTM	D5199	ol	Ē	200	213	213	213
Memrom 11, OH 66 fees the following research 1010086537 1010086548 1010086548					COMP	ASTM		Trans*	m²/sec	2.53 E-3	1.63 E-3	1.63 E-3	1.63 E-3
Memrom 11, OH 66 fees the following research 1010086537 1010086548 1010086548			sults for		COMP	ASTM	D7005	PLY-A	lb/in	2.43	1.03	1.03	1.03
Casocomposite Quality Certification Customer: AEG Environ 2074.2 Ke Destination: Harnibal, and certifies Agru America certifies Agra		mental mrom OH	s the following res							1010086537	1010086545	1010086548	1010086548
Customer: AEG	cation	Environ 7042 Ke Iannibal, 9456	a certifies					area	sdft	3625	2900	2900	2900
Customer:	y Certifi	307 107	America					len	⊭				200
Custome Custome Custome Properties	te Qualit	E # E #	Agru		İ			wid	#				
+ α ε 4 · · · ·	Geocomposit	Custome PO# Destination doc:		Type: 6-200				roll #		515314 .07	515522 .07	515523 .07	515524 .07
				<u> </u>				Į.		-	2 .	8	4



PO #: 004487

Weight: 201600 LB

Ship Date: 12/28/2006



Certificate of Analysis

Shipped To: AGRU AMERICA INC CPC Delivery #: 87305506

500 GARRISON RD

29440 GEORGETOWN SC

Fax:

Package: BULK Recipient: PALMER Mode: Hopper Car HCBX001790 Car #: Seal No: 458826

Product:

Marlex Polyethylene HHM 5502BN BULK

Lot Number: CTN610511

Property	Test Method	Value	Unit
Melt Index	ST-103	0.35	g/10mi
Density	ST-292	0.9547	g/cm3

The data set forth herein have been carefully compiled by Chevron Phillips Chemical Company LP.

However, there is no warranty of any kind, either expressed or implied, applicable to its use, and the user assumes all risk and liability in connection therewith.

Kay F. Donaldson

Quality Control Supervisor

For CoA questions contact Tom Scheirman at 832-813-4637



April 30, 2007

Agru/America, Inc. 500 Garrison Road Georgetown, SC 29440

Re: DalTex 1060E Purchase Order #: 4532

Doc#: 08770 Springhill Landfill

Roll #s: 1010086529 - 1010086560; 1010087553 - 1010087564; 1010088276 - 1010088286

Dear Sir/Madam:

This is to certify that DalTex 1060E is a high quality needle-punched nonwoven geotextile manufactured by DALCO Nonwovens, LLC of 100% polypropylene staple fibers. Stable within a pH range of 2 to 13, the fibers are randomly networked to form a high strength dimensionally stable fabric. This fabric resists ultraviolet deterioration, rotting and biological degradation and it is inert to commonly encountered soil chemicals. It meets or exceeds the following physical properties:

Fabric Property	Test Method	Units	Minimum Average
			Roll Value
Weight	ASTM D 3776	oz/yd²	6.0 (204 g/m ²)
Thickness	ASTM D 5199	mils	90 (2.29 mm)
Grab Tensile	ASTM D 4632	lbs.	170 (.760 kN)
Grab Elongation	ASTM D 4632	%	50
Trap Tear	ASTM D 4533	lbs.	70 (.312 kN)
Puncture	ASTM D 4833	lbs.	95 (.423 kN)
Mullen Burst	ASTM D 3786	psi	315 (2171 kPa)
Permittivity	ASTM D 4491	sec ⁻²	1.6
AOS	ASTM D 4751	US Sieve	70 (.212 mm)
UV Resistance	ASTM D 4355	% Strength	70
after 500 hrs.		Retained	

Sincerely,

Andrea Brawley

Quality Assurance Manager

Andrea D. Brawley

PURCHASE ORDER NUMBER: 4532

DOC#: 08770

PRODUC	T / STYL	PRODUCT / STYLE NAME:	DALTEX 1060E)E			SPRIN	SPRINGHILL LANDFILL	DFILL			
ROLL	AVERAGE WEIGHT MD	AVERAGE GRAB TENSILE MD	AVERAGE ELONGATION MD	AVERAGE GRAB TENSILE XMD	AVERAGE ELONGATION XMD	AVERAGE TRAP TEAR MD	AVERAGE TRAP TEAR XMD	AVERAGE PUNCTURE RESISTANCE	AVERAGE MULLEN BURST	PERMITTIVITY	WATER FLOW RATE	APPARENT OPENING SIZE
1010086529	7.9	218	99	217	67	109.2	120.6	112	382	1.9	159	70
1010086536	7.5	206	29	216	29	87	103	130	344	1.9	153	70
1010086543	7.3	200	61	196	7.0	66	104	108	340	2.1	172	70
1010086550	7.4	204	99	231	63	89.2	106.1	124	343	1.7	148	70
1010086557	6.5	218	99	227	80	109	138	125	340	1.9	153	70
1010087556	7.1	175	81	207	22	96	124	#	340	2.1	172	70
1010087563	6.8	189	63	214	82	107	127	66	330	1.9	153	70
1010088276	6.7	189	70	240	80	100	142	115	330	1.7	148	70
1010088281	6.5	190	09	219	70	105	127	119	340	2.1	172	70
1010088286	7.1	195	99	212	09	129	137	129	340	1.9	153	70
10	7.1	198	99	218	70	103.0	122.9	117	343	1.9	158	70
							4 0	Andrea S. Brawley Quality Manager		Andrea D. Brawley	Ser	

Page 13 of 80

2-Sided Geocomposite 200mil Geonet



Geonet Component

Property	Test Method	Value	es
Thickness, nominal (mm)	ASTM D5199	200	200
Thickness (min.), (mm)	ASTM D5199	180	180
Mass per Unit Area (min.), lbs./ft.2	ASTM D5261	.17	.17
Peak Tensile Strength (min.), lbs./in.	ASTM D5035	45	45
Melt Flow Index (max.), g/10 minutes	ASTM D1238, 190°C, 2.16kg	≤1.0	≤1.0
Density, (min.), g/cm ³	ASTM D792, Method B	0.94	0.94
Carbon Black Content (range in %)	ASTM D4218	2 - 3	2 - 3
Transmissivity ⁽¹⁾ (MARV), m²/sec.	ASTM D4716	1 x 10 ⁻³	1 x 10 ⁻³

Geotextile Component

Property	Test Method	Values
Mass per Unit Area (min. ave.), oz./sq. yd.	ASTM D5261	6.0 8.0
Grab Tensile Strength (min. ave.), lbs.	ASTM D4632	170 225
Grab Elongation (min. ave.), %	ASTM D4632	50 50
Trapezoidal Tear (min. ave.), lbs.	ASTM D4533	70 90
Puncture (min. ave.), lbs.	ASTM D4833	95 140
Mullen Burst (min. ave.), psi	ASTM D3786	325 400
Permittivity ⁽²⁾ (min. ave.), sec. ⁻¹	ASTM D4491	1.60 1.26
Water Flow ⁽²⁾ (min. ave.), gpm./ft ²	ASTM D4491	125 90
Apparent Opening Size (max.), U.S. Standard Sieve Size	ASTM D4751	70 80
UV Resistance after 500 hours (min. ave.), % Strength Retained	ASTM D4355	70 70

Geocomposite

Property	Test Method	Value	es
Laminated Strength (Ply Adhesion) (min. ave.), lbs./in.	ASTM D7005	1	1
Transmissivity ⁽³⁾ (MARV), m²/sec.	ASTM D4716 Applies to 2-sided only. 1-sided values are higher (~ 1E-3).		1 x 10 ⁻⁴

Notes: (1) Geonet Transmissivity at a temp. of 21°C, gradient of 1.0 and a load of 15,000 psf: seating time 15 min. between steel plates.

- (2) At time of manufacture. Handling may change these properties.
- (3) Geocomposite Transmissivity at a temp. of 21°C, gradient of 0.1 and a load of 10,000 psf: seating time 15 min. between steel plates.

Notes:

All information, recommendations and suggestions appearing in this literature concerning the use of our products are based upon tests and data believed to be reliable; however, it is the users responsibility to determine the suitability for their own use of the products described herein. Since the actual use by others is beyond our control, no guarantee or warranty of any kind, expressed or implied, is made by Agru/America as to the effects of such use or the results to be obtained, nor does Agru/America assume any liability in connection herewith. Any statement made herein may not be absolutely complete since additional information may be necessary or desirable when particular or exceptional conditions or circumstances exist or because of applicable laws or government regulations. Nothing herein is to be construed as permission or as a recommendation to infringe any patent.

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Fax: 843-527-2738

High Density Polyethylene Micro Spike[®] Liner



Product Data

Property	Test Method	Value	6			
Thickness, nominal (mm)		30 (.75)	40 (1.0)	60 (1.5)	80 (2.0)	100 (2.5)
Thickness (min. ave.), mil (mm)	ASTM D5994*	29 (.71)	38 (.95)	57 (1.43)	76 (1.90)	95 (2.38)
Thickness (lowest indiv. for 8 of 10 spec.), mil (mm)	ASTM D5994*	27 (.68)	36 (.90)	54 (1.35)	72 (1.80)	90 (2.25)
Thickness (lowest indiv. for 1 of 10 spec.), mil (mm)	ASTM D5994*	26 (.64)	34 (.85)	51 (1.28)	68 (1.70)	85 (2.13)
*The thickness values may be chan	ged due to project specifications (i.e., absolu	te minimu	m thicknes	s)	
Asperity Height (min. ave.), mil (mm)	GRI GM12	16 (.41)	16 (.41)	16 (.41)	16 (.41)	16 (.41)
Density, g/cc, minimum	ASTM D792, Method B	0.94	0.94	0.94	0.94	0.94
Tensile Properties (ave. both directions)	ASTM D6693, Type IV					
Strength @ Yield (min. ave.), lb/in width (N/mm)	2 in/minute	66 (11.6)	88 (15.4)	132 (23.1)	176 (30.8)	220 (38.5)
Elongation @ Yield (min. ave.), % (GL=1.3in)	5 specimens in each direction	13	13	13	13	13
Strength @ Break (min. ave.), lb/in width (N/mm)		66 (11.6)	88 (15.4)	132 (23.1)	176 (30.8)	220 (38.5)
Elongation @ Break (min. ave.), % (GL=2.0in)		350	350	350	350	350
Tear Resistance (min. ave.), lbs. (N)	ASTM D1004	23 (102)	30 (133)	45 (200)	60 (267)	72 (320)
Puncture Resistance (min. ave.), lbs. (N)	ASTM D4833	60 (267)	90 (400)	120 (534)	150 (667)	180 (801)
Carbon Black Content (range in %)	ASTM D4218	2 - 3	2-3 2-3 2-3 2-3		2 - 3	2 - 3
Carbon Black Dispersion (Category)	ASTM D5596	Only near spherical agglomerates				
		for 10 views: 9 views in Cat. 1 or 2, and 1 view in Cat.				w in Cat. 3
Stress Crack Resistance (Single Point NCTL), hours	ASTM D5397, Appendix	300	300	300	300	300
Oxidative Induction Time, minutes	ASTM D3895, 200°C, 1 atm O ₂	≥100	≥100	≥100	≥100	≥100
Melt Flow Index, g/10 minutes	ASTM D1238, 190°C, 2.16kg	≤1.0	≤1.0	≤1.0	≤1.0	≤1.0
Oven Aging	ASTM D5721	80	80	80	80	80
with HP OIT, (% retained after 90 days)	ASTM D5885, 150°C, 500psi O ₂					
UV Resistance	GRI GM11	20hr. Cyc	le @ 75°C/	4 hr. dark co	ndensation (@ 60°C
with HP OIT, (% retained after 1600 hours)	ASTM D5885, 150°C, 500psi O ₂	50	50	50	50	50

These product specifications meet or exceed GRI's GM13

Supply Information (Standard Roll Dimensions)

Thic mil	kness mm	Wie ft	dth m	Lei ft	ngth m	Area (ft²	approx.) m ²	Weight lbs	(average) kg
30	.75	23	7	600.1	182.9	13,782	1,280	3,325	1,510
40	1.0	23	7	600.1	182.9	13,782	1,280	3,325	1,510
60	1.5	23	7	410.1	125	9,419	875	3,356	1,522
80	2.0	23	7	328.1	100	7,535	700	3,306	1,500
100	2.5	23	7	246.1	75	5,651	525	3,167	1,436

Notes:

All rolls are supplied with two slings. All rolls are wound on a 6 inch core. Special roll lengths are available on request.

All information, recommendations and suggestions appearing in this literature concerning the use of our products are based upon tests and data believed to be reliable; however, it is the users responsibility to determine the suitability for their own use of the products described herein. Since the actual use by others is beyond our control, no guarantee or warranty of any kind, expressed or implied, is made by Agru/America as to the effects of such use or the results to be obtained, nor does Agru/America assume any liability in connection herewith. Any statement made herein may not be absolutely complete since additional information may be necessary or desirable when particular or exceptional conditions or circumstances exist or because of applicable laws or government regulations. Nothing herein is to be construed as permission or as a recommendation to infringe any patent.

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GEO MENDRANE



Product Data Sheet

GSE STANDARD PRODUCTS

GSE HD Textured

GSE HD Textured is the textured version of GSE HD. It is a high quality, high density polyethylene (HDPE) geomembrane with one or two coextruded, textured surfaces, and consisting of approximately 97.5% polyethylene, 2.5% carbon black and trace amounts of antioxidants and heat stabilizers; no other additives, fillers or extenders are used. The resin used is specially formulated, virgin polyethylene and is designed specifically for flexible geomembrane applications. GSE HD Textured has excellent resistance to UV radiation and is suitable for exposed conditions. This product allows projects with greater slopes to be designed since frictional characteristics are enhanced. These product specifications meet or exceed GRI GM13.

Preduct Specifications

TESTED PROPERTY	TEST METHOD	FREQUENCY	'* £	٠,		MINE	MUM V	ALUE	
Product Code		521,		нг	Т	HDT	HOT	HDT	HDT
rroduct Cove						040G000	0600000	080C000	100G000
Thickness, (minimum average) mll (mm)	A5TM D 5994	every roll).73)	38 (0.96)	57 (1.45)	76 (1.93)	95 (2.41)
Lowest individual for 8 out of 10 values		1	27	7 (6).6 9 }	36 (0.91)	54 (1.40)	72 (1.80)	90 (2.30)
Lowest individual for any of the 10 values			26	ŝ (),66}	34 (0.86)	51 (1.30)	68 (1.73)	85 (2.16)
Density, g/cm ²	ASTM D 1505	200,000 lb	I	٥.	4	0.94	0.94	0.94	0.94
Tensile Properties (each direction)**	ASTM D 6693, Type IV	20,000 lb	П						
Strength at Break, lb/in-width (N/mm)			4	5	(8)	60 (11)	90 (16)	120(21)	150 (27)
Strength at Yield, Ib/in-width (N/mm)			. 1		11)	84 (15)	126 (22)	168 (29)	210 (37)
Elongation at Break, %	G.L. = 2.0 in (51 mm)			10	n	100	100	100	100
Elongation at Yield, %	G.L. = 1.3 in (33 mm)		i	1,	2	_12	12	12:	12
Tear Resistance, Ib (N)	ASTM D 1004	45,000 %	2	1 (93) (28 (125))42 (187)	56 (249)	70 (311)
Puncture Resistance, lb (N)	ASTM D 4833	45,000 lb	45	5 (200)	60 (267)	90 (400)	120 (S34)	150 (667)
Carbon Black Content %	ASTM D 1603	20.000 lb	İΤ	2.	0	2.0	2.0	2.0	2.0
Carbon Black Dispersion	ASTM D 5596	45,000 lb	+1	No	te î	+Note I	+Note 1	+Note 1	+Note 1
Asperity Height	GRI GM 12	second roll	1	No	te 2	+Note 2	+Note 2	+Note 2	+Note 2
Notched Constant Tensile Load ^a , hr	ASTM D 5397, Appendix	200,000 lb	П	30) 0	300	300	300	300
REFERENCE PROPERTY	TEST METHOD	FREQUENCY		÷.	,	NO	MINAL	MLUE	e1
Oxidative Induction Time, min	A5TM D 3895, 200° C; O ₂ , 1 atm	200,000 lb		>	00	>100	>100	>100	>100
Roll Length ⁽¹⁾ (approximate), ft (m)	Standard Textured		18	30	(253)	700 (213)	520 (15B)	1	330 (101)
Roll Width ^m , ft (m)			TΣ	2.	(6.9)	22.5 (6.9)	22.5 (6.9)	22.5 (6.9)	22.5 (6.9)
Roll Area, if (m ¹)		1	17	18	674 735)	15,750 (1,463)	11,700 (1,087)	9,000 (836)	7,425 (690)

NOTES:

- . +Note 1: Dispersion only applies to near spherical agglomorates. O of 10 views shall be Cotagony 1 for 2. No more than 1 view from Catagony 2.
- * Note 2: 10 mil gverage, 6 of 10 readings ≳7 mils. Lowest Individual ≥ 5 mils.
 GSE HD Standard-Textured is avoitable in relia weighing about 4,000 to [1,800 kg].
- " "The combination of stress concentrations due to coextrusion texture geometry and the small epecimen tize results in large variation of text results. Therefore, these tenslie properties are minimum average values.
- MCTL for HD Textured is conducted an representative smooth membrane complete.
- . All QSE gromymbranes have dimensional stability of 22% when lested with ASTM D 1204 and LTB of 277° C whon total with ASTM D 746.

mRoll lengths and widths have a tolerance of ± 1%.

DS006 HD18XT R08/09/02

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GSE STANDARD PRODUCTS

GSE HD Textured

GSE HD Textured is the textured version of GSE HD. It is a high quality, high density polyethylene (HDPE) geomembrane with one or two coextruded, textured surfaces, and consisting of approximately 97.5% polyethylene, 2.5% carbon black and trace amounts of antioxidants and heat stabilizers; no other additives, fillers or extenders are used. The resin used is specially formulated, virgin polyethylene and is designed specifically for flexible geomembrane applications. GSE HD Textured has excellent resistance to UV radiation and is suitable for exposed conditions. This product allows projects with greater slopes to be designed since frictional characteristics are enhanced. These product specifications meet or exceed GRI GM13.

Product Specifications

TESTED PROPERTY	TEST METHOD	FREQUENCY	/	MINI	MUM V	ALUE		
Product Code			HDT	HDT	HDT	HDT	HDT	
			030G000	040G000	060G000	080G000	100G000	
Thickness, (minimum average) mil (mm)	ASTM D 5994	every roll	29 (0.73)	38 (0.96)	57 (1.45)	76 (1.93)	95 (2.41)	
Lowest individual for 8 out of 10 values			27 (0.69)	36 (0.91)	54 (1.40)	72 (1.80)	90 (2.30)	
Lowest individual for any of the 10 values			26 (0.66)	34 (0.86)	51 (1.30)	68 (1.73)	85 (2.16)	
Density, g/cm³	ASTM D 1505	200,000 lb	0.94	0.94	0.94	0.94	0.94	
Tensile Properties (each direction) ⁽¹⁾	ASTM D 6693, Type IV	20,000 lb						
Strength at Break, lb/in-width (N/mm)	Dumbell, 2 ipm		45 (8)	60 (11)	90 (16)	120(21)	150 (27)	
Strength at Yield, lb/in-width (N/mm)			63 (11)	84 (15)	126 (22)	168 (29)	210 (37)	
Elongation at Break, %	G.L. = 2.0 in (51 mm)		100	100	100	100	100	
Elongation at Yield, %	G.L. = 1.3 in (33 mm)		12	12	12	12	12	
Tear Resistance, lb (N)	ASTM D 1004	45,000 lb	21 (93)	28 (125)	42 (187)	56 (249)	70 (311)	
Puncture Resistance, lb (N)	ASTM D 4833	45,000 lb	45 (200)	60 (267)	90 (400)	120 (534)	150 (667)	
Carbon Black Content, %	ASTM D 1603	20,000 lb	2.0	2.0	2.0	2.0	2.0	
Carbon Black Dispersion	ASTM D 5596	45,000 lb	+Note 1	+Note 1	+Note 1	+Note 1	+Note 1	
Asperity Height	GRI GM 12	second roll	+Note 2	+Note 2	+Note 2	+Note 2	+Note 2	
Notched Constant Tensile Load ⁽²⁾ , hr	ASTM D 5397, Appendix	200,000 lb	300	300	300	300	300	
REFERENCE PROPERTY	TEST METHOD	FREQUENCY	′	NOMINAL VALUE				
Oxidative Induction Time, min	ASTM D 3895, 200° C; O ₂ , 1 atm	200,000 lb	>100	>100	>100	>100	>100	
Roll Length ⁽³⁾ (approximate), ft (m)	Standard Textured		830 (253)	700 (213)	520 (158)	400 (122)	330 (101)	
Roll Width ⁽³⁾ , ft (m)			22.5 (6.9)	22.5 (6.9)	22.5 (6.9)	22.5 (6.9)	22.5 (6.9)	
Roll Area, ft ² (m ²)			18,674 (1,735)	15,750 (1,463)	11,700 (1,087)	9,000 (836)	7,425 (690)	

NOTES:

- +Note 1: Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
- +Note 2: 10 mil average. 8 of 10 readings ≥7 mils. Lowest individual ≥ 5 mils.
- GSE HD Standard Textured is available in rolls weighing about 4,000 lb (1,800 kg).
- "The combination of stress concentrations due to coextrusion texture geometry and the small specimen size results in large variation of test results. Therefore, these tensile properties are minimum average values.
- 12) NCTL for HD Textured is conducted on representative smooth membrane samples.
- All GSE geomembranes have dimensional stability of ±2% when tested with ASTM D 1204 and LTB of <-77° C when tested with ASTM D 746.
- $^{(3)}$ Roll lengths and widths have a tolerance of \pm 1%.

DS006 HDtext R03/09/06

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South America	GSE Lining Technology Chile S.A.	Santiago, Chile		56 2 595 4200	Fax: 56 2 595 4290
Asia Pacific	GSE Lining Technology Company Limited	Bangkok, Thailand		66 2 937 0091	Fax: 66 2 937 0097
Europe & Africa	GSE Lining Technology GmbH	Hamburg, Germany		49 40 767420	Fax: 49 40 7674234
Middle East	GSE Lining Technology-Egypt	The 6th of October City, Egypt		202 2 828 8888	Fax: 202 2 828 8889



1359-A Ellsworth Industrial Boulevard • Atlanta, GA 30318 • TEL 404-636-0928 • FAX 404-636-7162

31 July 2007

Gary Rogers KEMRON Environmental Services, Inc. 1359-A Ellsworth Industrial Blvd. Atlanta, GA 30318

Re: Ormet Geotechnical Testing

Final Letter Report

KEMRON Project #SE0218

Dear Mr. Rogers:

KEMRON Environmental Services, Inc. (KEMRON) is pleased to present this report summarizing the testing results performed for the Ormet Site.

The results of testing are summarized in Table 1 attached to this letter followed by the testing data sheets.

KEMRON Environmental Services, Inc. is pleased to present you with this final letter report for the Ormet Site testing. If you have any questions, or require additional information, please contact either of the undersigned.

Sincerely,

KEMRON Environmental Services, Inc.

Mark Clark

Applied Technologies Group

Project Manager

(404) 636-0928 mclark@kemron.com

Attachments

Kelly Clemons Applied Technologies Group Program Manager (404) 601-6910

Why or Clemans

kclemons@kemron.com



ORMET SITE TESTING

TABLE 1
Summary of Analyses

TESTING	TEST		RES	ULTS
PARAMETER	METHOD	UNIT	BORROW	STOCKPILE
PHYSICAL PROPERTIES				
Particle Size Analysis	ASTM D422			
- Gravel		%	9.6	6.3
- Sand		%	25.8	17.4
- Silt		%	35.9	34.5
- Clay		%	28.7	41.8
Atterberg Limits	ASTM D4318			
- Liquid Limit		-	29	42
- Plastic Limit		-	17	19
- Plasticity Index		-	12	23
Soil Classification	ASTM D2487			
- USCS		-	CL	CL
- AASHTO		-	A-6	A-7-6
Moisture Content	ASTM D2216	%	7.56	15.88
Percent Solids	NA	%	92.97	86.29
Standard Proctor Compaction	ASTM D698			
- Maximum Dry Density		pcf	112.4	105.3
- Optimum Moisture		%	14.8	18.4
Friction Angle - Direct Shear	ASTM D3080	lb/ft³		
- Cohesion		psf	0	0.000
- Ф		degrees	57.7	61.4

COC No. A 66800

156 Starlite Drive Marietta, OH 45750

CHAIN-OF-CUSTODY RECORD ENVIRONMENTAL SERVICES Kenkon

Phone: 740-373-4071

Fax: 740-373-4835

Company Name:		hos		-80Z 869 (1		Program
Project Contact: Co	Contact Phone #: 576 31	M					☐ AFCEE
Turn Around Requirements:	Location:						RCRA
Project #: 95 4489 Pro	Project Name: GDMET			VV)			Other
Sampler (print): Sig	Signature:	A M) TBJ 2 V PILS	48 ± 4000			ADDITIONAL
Sample Comp*	. Time CWA	NUMBE	<u>-</u>	אנדים ליסטיא			REQUIREMENTS
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PART 2 PRODUCTS

2.1 VEGETATIVE SUPPORT LAYER SOIL

2.1.1 VSL Soil Description

VSL soil shall consist of natural, friable soil and shall be free of debris, frozen materials, angular rocks, clay lumps, objectionable weeds, litter, brush, matted roots, chemical contamination, toxic substances, and any material that might be harmful to plant growth or be a hindrance to grading, planting, or maintenance operations.

VSL soil shall have sufficient fertility to support vegetation.

2.1.2 Classification Testing

Borrow source assessment tests shall be performed on the material proposed for use in the vegetative support layer to ensure compliance with specified requirements. At least one set of borrow assessment tests shall be performed on each borrow source proposed for use. A set of borrow source assessment tests shall consist of Atterberg limits (ASTM D 4318), particle size analysis (ASTM D 422), and moisture content (ASTM D 2216). Based on borrow source assessment testing, soils shall be classified in accordance with ASTM D 2487.

2.1.3 Moisture-Density (Compaction) Testing

A representative sample from each principal type or combination of borrow materials shall be tested to establish compaction curves using ASTM D 698. At least one compaction test shall be performed on each borrow source proposed. A minimum of 5 points shall be used to develop each compaction curve.

TABLE 1
VEGETATIVE SUPPORT LAYER SOIL TESTING FREQUENCIES

Property	Frequency (Note 1)	Test Method
Grain size analysis	Once, project start	ASTM D 422
Moisture content	Once (Note 2)	ASTM D 2216
Atterberg limits	Once,project start	ASTM D 4318
Compaction	Once, project start	ASTM D 698
Direct shear	Once, project start	ASTM D 3080

Note 1: The Owner's Representative may require additional tests if the soil characteristics of the incoming soil appear to change as the Project progresses.

Note 2: Additional moisture content tests will be taken daily as part of compaction control.

2.1.4 Chemical Contamination Certification

Borrow used for the Vegetative Support Layer shall be certified by the Contractor to be free of chemical contamination.

2.1.5 VSL Borrow Soil Acceptance Criteria

Test results must comply with the requirements listed in Table 2 or the

material will be rejected for use.

TABLE 2
REQUIRED PHYSICAL PROPERTIES OF VSL SOIL

Property	Test Value	Test Method
Soil classification	Low plasticity clay (CL)	ASTM D 2487
Max. particle size	1.0 inch	ASTM D 422
Liquid Limit	39% +/-5%	ASTM D 4318
Plasticity Index	22% +/-5%	ASTM D 4318
Friction Angle	32 degrees	ASTM D 3080

2.2 MATERIAL FOR RIP-RAP

2.2.1 Rip-Rap for Riverbank Protection

Provide rock conforming to Ohio DOT Type C for reconstruction of riverbank erosion protection. Type C material has at least 85 percent of the total material by weight larger than a 6-inch (150 mm) but less than an 18-inch (0.5 m) square opening and at least 50 percent of the total material by weight larger than a 12-inch (0.3 m) square opening. Furnish material smaller than a 6-inch (150 mm) square opening that consists predominantly of rock spalls and rock fines, and that is free of soil.

Provide rock fragments sufficiently durable to ensure permanence in the structure and the environment in which it is to be used. Use rock fragments free from cracks, seams, and other defects that would increase the risk of deterioration from natural causes. Do not permit the inclusion of more than trace quantities of dirt, sand, clay, and rock fines.

Salvage and reuse of rip-rap disturbed by the displacement of the CMSD landfill cover soils is encouraged.

2.2.2 Rip-Rap for Midslope Diversion Channels

Provide rock conforming to Ohio DOT Type D for construction of Midslope Diversion Berms. Type D material has at least 85 percent of the total material by weight larger than a 3-inch (75 mm) but less than a 12-inch (0.3 m) square opening and at least 50 percent of the total material by weight larger than a 6-inch (150 mm) square opening. Furnish material smaller than a 3-inch (75 mm) square opening that consists predominantly of rock spalls and rock fines, and that is free of soil.

Provide rock fragments sufficiently durable to ensure permanence in the structure and the environment in which it is to be used. Use rock fragments free from cracks, seams, and other defects that would increase the risk of deterioration from natural causes. Do not permit the inclusion of more than trace quantities of dirt, sand, clay, and rock fines.

Salvage and reuse of rip-rap disturbed by the displacement of the CMSD landfill cover soils is encouraged.

Kelly Clemons

From: Grismala, Ralph [RGrismala@icfi.com]

Sent: Tuesday, July 17, 2007 10:16 AM

To: Kelly ClemonsCc: Zhang, Lianyang

Subject: Ormet VSL Direct shear test parameters

Ms. Clemons,

As discussed during our telephone conversation, please perform the direct shear tests on the Vegetative Support Layer (VSL) soil in accordance with the specifications below.

Thanks, Ralph

The CMSD VSL Direct Shear Testing shall follow the procedure defined by ASTM D3080, Standard Test Method for Direct Shear Test of Soils Under Consolidated Drained Conditions and the specific conditions listed below:

- \circ VSL soil: The VSL soil, at $\pm 0.5\%$ of the water content measured in the field (24.6%) shall be placed in the shear box at a total density equivalent to that measured in the field (122.4 pcf).
- o Normal stresses: The interface testing shall be done at three different normal stresses: 190 psf, 237.5 psf, and 297 psf.
- o Rate of shearing: The shear force shall be applied at a constant rate of displacement equal to 0.005 in/min.
- Test results: The test results shall include, in addition to the results specified in D3080, the test data in tabular form in an electronic file, including, at a minimum, the time, shear force and horizontal displacement for each manual or automatic reading throughout the test.

If the laboratory technician or engineer has questions or concerns regarding any of the above test conditions or procedures, please contact Ralph Grismala at ICF International, (860)599-3534.

Ralph Grismala, P.E.

ICF International
(860)599-3534 Tel
(860)599-3534 Fax

E-mail: rgrismala@icfi.com Website: www.icfi.com

MOISTURE-DENSITY RELATIONSHIP TEST

Curve No.:

Project No.: SE-0218

Project: ORMET-4489 Location: KEMRON

Elev/Depth: Remarks:

MATERIAL DESCRIPTION

Description: Stockpile

Classifications: USCS:

AASHTO:

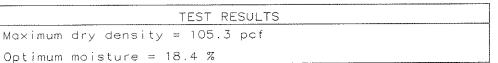
Date: 7/2/2007

Nat. Moist. = %

Sp.G. =

Liquid Limit =

Plasticity Index =



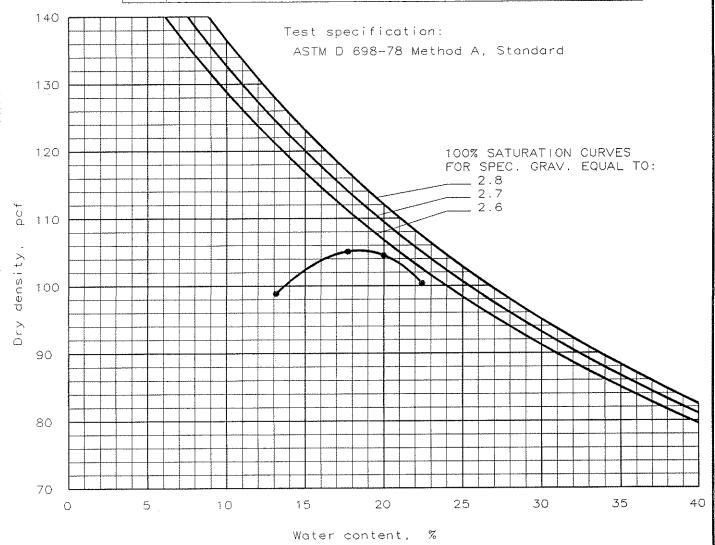


Plate No. 1

MOISTURE-DENSITY RELATIONSHIP TEST

Curve No.:

Project No.: SE-0218

Project: ORMET-4489 Location: KEMRON

Elev/Depth:

Remarks:

MATERIAL DESCRIPTION

Description: Borrow

Classifications: USCS: Nat. Moist. = %

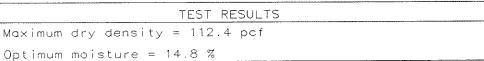
AASHTO:

Date: 7/2/2007

Sp.G. =

Liquid Limit =

Plasticity Index =



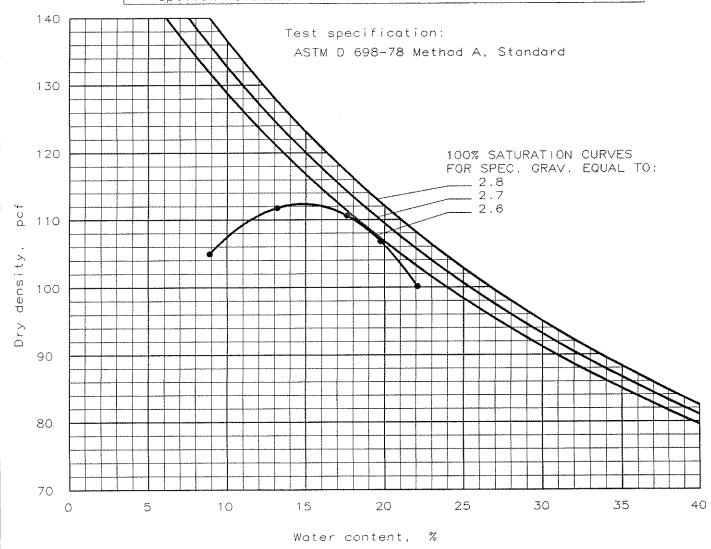


Plate No. 1

JULY 2007

SUMMARY OF SOIL DATA KEMRON/ORMET/GA

								-	J.	Grain Size								
			Soil	Natural		Atterberg	berg		Dist	Distribution		Compaction	ıction					Additional
Sample	Sample	Sample	Classi-	Moisture		Limits	uits	% E	% Finer % Finer		% Finer	Maximum	Optimum		Unit	Unit Weight	Permeability	Tests
Identification	Type	Depth	fication	%				No. 4	4.			Dry Density	Moisture		Moisture	Dry	(cm/sec)	Conducted
					T.T.	P.L.	P.I. L.I.	I. Sieve		Sieve	шш	(Ib/cuft)	%	Gs.	%	(lb/cuft)		(See Notes)
1(Stockpile)	Bag	-	(CF)	-	-	1	1			ı	-	1	1		18.3	89.5 / 100.0	1	DS
2(Borrow)	Bag	ī	(CT)	1	1	1	-	ı		1	-	ı	1	J	14.7	95.5 / 106.8	ı	DS
								_										
					-													
Page :	ABBREV	ABBREVIATIONS: LIQUID LIMIT (LL)	LIQUD	LIMIT (L)	3							NOTES:	T = TRIAXIAL TEST	XIAL	TEST		Į.	
26 of 80			PLASTIC PLASTIC LIQUIDI SPECIFI	PLASTIC LIMIT (PL) PLASTICITY INDEX (PI) LIQUIDITY INDEX (LI) SPECIFIC GRAVITY (Gs)	K (E.D.)	ં ઉ							U = UNC C = CON DS = DIRI O = ORG	ONFIN SOLID ECT SE	U = UNCONFINED COMPRE C = CONSOLIDATION TEST DS = DIRECT SHEAR TEST O = ORGANIC CONTENT	U = UNCONFINED COMPRESSION LEST C = CONSOLIDATION TEST DS = DIRECT SHEAR TEST O = ORGANIC CONTENT	I.S	

MOISTURE (Mc)

O = ORGANIC CONTENT P = pH

Golder Associates Inc.

DIRECT SHEAR

ASTM D 3080

PROJECT NAME:

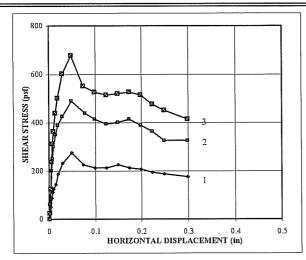
SAMPLE ID:

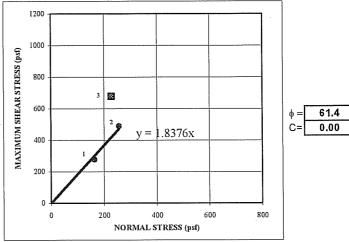
KEMRON/ORMET/GA

PROJECT NUMBER:

073-90189 1 (Stockpile)

DEPTH:





SI	PECIMEN	1
Normal Stre	ess (psf)	164.5
t50 (min	utes)	1.00
SPEED	mm/min	0.120
Sample Dian	neter (in)	2.50
Moisture Cor	itent (%)	18.3
Wet Density	(pcf)	105.8
Dry Density (pcf)	89.5
Void Ratio		0.848
Saturation (%	G)	57.0

Void (Vallo	0.040
Saturation (%)	57.0
HORIZONTAL	SHEAR
DISPLACEMENT	STRESS
(in)	(psf)
0.000	0.0
0.002	0.0
0.004	50.1
0.005	87.7
0.007	112.8
0.009	125.3
0.014	144.2
0.019	188.1
0.029	232.0
0.049	275.9
0.074	225.7
0.099	213.2
0.124	213.2
0.149	225.7
0.174	213.2
0.199	206.9
0.224	194.3
0.249	188.1
0.299	175.5

SPECIMEN	2
Normal Stress (psf)	257.0
t50 (minutes)	1.86
SPEED mm/min	0.120
Sample Diameter (in)	2.50
Moisture Content (%)	18.3
Wet Density (pcf)	105.8
Dry Density (pcf)	89.5
Void Ratio	0.848
Saturation (%)	57.0

HORIZONTAL	SHEAR
DISPLACEMENT	STRESS
(in)	(psf)
0.000	0.0
0.002	62.6
0.003	125.3
0.005	200.6
0.007	250.8
0.009	301.0
0.014	351.2
0.019	388.8
0.028	426.4
0.048	489.2
0.077	439.0
0.098	413.9
0.123	395.1
0.148	401.3
0.173	413.9
0.199	388.8
0.224	363.7
0.249	326.1
0.299	326.1

Normal Stress (psf) 229.7		
229.7		
0.21		
0.120		
2.50		
18.3		
118.3		
100.0		
0.654		
74.0		

Gaturation (70)	7 7.0
HORIZONTAL DISPLACEMENT	SHEAR STRESS
(in)	(psf)
0.000	0.0
0.002	25.0
0.003	125.3
0.005	238.2
0.007	313.5
0.009	363.7
0.013	439.0
0.018	501.7
0.028	602.1
0.048	677,3
0.073	551.9
0.098	526.8
0.123	514.2
0.148	520.5
0.173	526.8
0.198	514.2
0.223	476.6
0.248	451.5
0.298	413.9

275.9

489.2

677.3

REMARKS

Per clients request Specimens 1 & 2 were remolded to 85% of the max dry density @ 0.1% below Opt. MC

Per clients request Specimen 3 was remolded to 95% of the max dry density @ 0.1% below Opt. MC

Per clients request the specimens were sheared at a shear rate 0.120 mm/min (0.005 in/min)

DESCRIPTION Brown, SILTY CLAY, some fine sand.

USCS (CL)

TECH DATE CHECK REVIEW AK 07/19/07 DA P.J.M

DIRECT SHEAR

ASTM D 3080

PROJECT NAME:

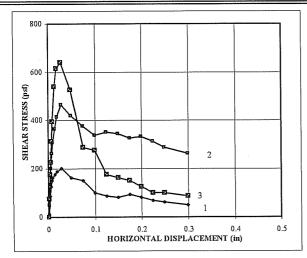
SAMPLE ID:

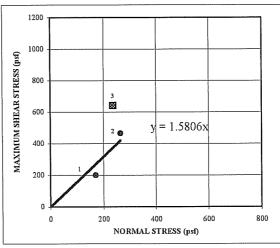
KEMRON/ORMET/GA

PROJECT NUMBER:

073-90189 2 (Borrow)

DEPTH:





φ =	57.7	0
C=	0.00	psf

SPECIMEN	1
Normal Stress (psf)	170.2
t50 (minutes)	0.02
SPEED mm/min	0.120
Sample Diameter (in)	2.50
Moisture Content (%)	14.7
Wet Density (pcf)	109.6
Dry Density (pcf)	95.5
Void Ratio	0.732
Saturation (%)	53.3

Oditilation (70)	
HORIZONTAL DISPLACEMENT	SHEAR STRESS
(in)	(psf)
0.000	0.0
0.002	12.4
0.003	87.7
0.005	125.3
0.007	150.4
0.009	163.0
0.014	175.5
0.019	188.1
0.029	200.6
0.049	163.0
0.074	150.4
0.099	100.2
0.124	87.7
0.149	81.4
0.174	94.0
0.199	81.4
0.225	68.9
0.250	62.6
0.300	50.1

SPECIMEN	2
Normal Stress (psf)	265.9
t50 (minutes)	0.30
SPEED mm/min	0.120
Sample Diameter (in)	2.50
Moisture Content (%)	14.7
Wet Density (pcf)	109.6
Dry Density (pcf)	95.5
Void Ratio	0.732
Saturation (%)	53.3

HORIZONTAL	SHEAR
DISPLACEMENT	STRESS
(in)	(psf)
0.000	0.0
0.002	50.1
0.003	125.3
0.005	200.6
0.007	263.3
0.009	307.2
0.014	363.7
0.018	413.9
0.028	464.1
0.048	420.2
0.074	376.2
0.099	338.6
0.124	351.2
0.149	344.9
0.174	326.1
0.199	332.3
0.224	313.5
0.249	288.4
0.299	263.3

SPECIMEN	3
Normal Stress (psf)	237.9
t50 (minutes)	0.02
SPEED mm/min	0.120
Sample Diameter (in)	2.50
Moisture Content (%)	14.7
Wet Density (pcf)	122.5
Dry Density (pcf)	106.8
Void Ratio	0.549
Saturation (%)	71.1

Julianon (10)	
HORIZONTAL	SHEAR
DISPLACEMENT	STRESS
(in)	(psf)
0.000	0.0
0.001	75.2
0.003	175.5
0.005	225.7
0.007	313.5
0.008	395.1
0.013	539.3
0.018	614.6
0.028	639.7
0.048	526.8
0.074	288.4
0.099	275.9
0.124	175.5
0.149	163.0
0.174	150.4
0.199	125.3
0.224	100.2
0.249	100.2
0.299	87.7

200.6

464.1

639.7

REMARKS

Per clients request Specimens 1 & 2 were remolded to 85% of the max dry density @ 0.1% below Opt. MC

Per clients request Specimen 3 was remolded to 95% of the max dry density @ 0.1% below Opt. MC

Per clients request the specimens were sheared at a shear rate 0.120 mm/min (0.005 in/min)

DESCRIPTION Brown, SILTY CLAY, some fine sand.

USCS (CL)

TECH DATE CHECK REVIEW



ATTERBERG LIMITS

REPORT FORM ASTM D 4318 (Method B)

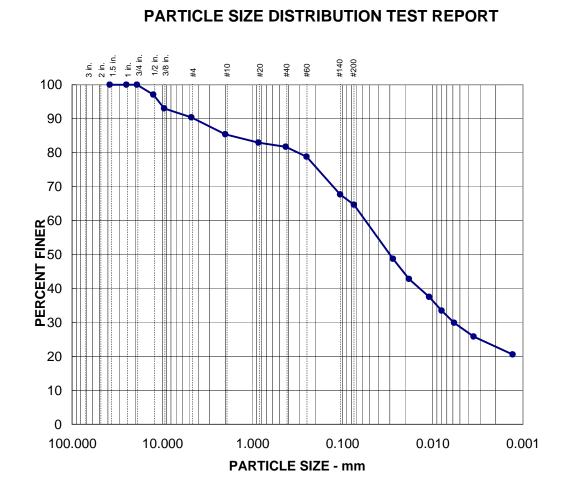
Project:ORMET-4489Testing Date:7/2/2007Project No.:SE-0218Tested By:rrbSample No.:BorrowTracking Code:4305_ATDescription:Light Brown

Liquid Limit Determination			
Pan No.	А	В	
Pan Weight	2.18 g	2.14 g	
Wet Soil + Pan	12.61 g	12.49 g	
Dry Soil + Pan	10.27 g	10.17 g	
Wt of Dry Soil, Ws	8.09 g	8.03 g	
Wt of Water, Ww	2.35 g	2.32 g	
Moisture Content, ASTM	29.00 %	28.89 %	
No. of Blows, N	27	28	
Correction Factor, K	1.009	1.014	
Liquid Limit	29	29	

Liquid Limit: 29
Plastic Limit: 17
Plasticity Index: 12

N	k
20	0.974
21	0.979
22	0.985
23	0.990
24	0.995
25	1.000
26	1.005
27	1.009
28	1.014
29	1.018
30	1.022

Plastic Limit Determination			
Pan No.	С		D
Pan Weight	2.15	g	2.14 g
Wet Soil + Pan	13.83	g	13.07 g
Dry Soil + Pan	12.15	g	11.51 g
Wt of Dry Soil, Ws	10.00	g	9.37 g
Wt of Water, Ww	1.68	g	1.56 g
Moisture Content, ASTM	16.82	%	16.65 %
Plastic Limit	17	%	17 %



% GRAVEL	% SAND	% SILT % CLAY		
9.6	25.8	35.9	28.7	

SAMPLE		
INFORMATION		
Project Name:	ORMET-4489	
Project Number:	SE-0218	
Sample ID:	Borrow	
Sample Description:	Light Brown	
Testing Date:	06/29/07	



SAMPLE CLASSIFICATION			
Liquid Limit:	29		
Plastic Limit:	17		
Plasticity Index:	12		
USCS Classification			
Classification	CL		
AASHTO Classification			
Classification	A-6		
Group Index	5		
DESCRIPTION:			
Sandy Lean Clay			

PARTICLE SIZE DISTRIBUTION TEST REPORT PAGE 1 OF 2

PARTICLE SIZE DISTRIBUTION DATA REPORT

REPORT FORM ASTM D422

 PROJECT:
 ORMET-4489

 PROJECT No.:
 SE-0218

 SAMPLE No.:
 Borrow

 SAMPLE DESCRIPT:
 Light Brown

 TESTING DATE:
 06/29/07

 TESTED BY:
 RRB

 TRACKING CODE:
 4305_GR

MOISTURE CONTENT (DRY AND WET PASIS)				
MOISTURE CONTENT (DRY AND WET BASIS)				
TARE WEIGHT	230.86 g			
WT WET SOIL + TARE	320.40 g			
WT DRY SOIL + TARE	314.31 g			
WT WATER, Ww	6.09 g			
WT DRY SOIL, Ws	83.45 g			
ASTM MOISTURE	7.30 %			
EPA MOISTURE	6.80 %			

SIEVE NUMBER	PERCENT PASSING
1.5	100.0 %
1.0	100.0 %
0.75	100.0 %
0.5	97.1 %
0.375	93.1 %
#4	90.4 %
#10	85.4 %
#20	83.0 %
#40	81.8 %
#60	78.8 %
#140	67.7 %
#200	64.6 %

HYDROMETER ANALYSIS		
HYDROMETER No.	1	
Wt OF DRY SOIL, Ws	53.95	
DATE TESTING INITIATED	07/02/07	
TIME TESTING INITIATED	10:30:00 AM	

ELAPSED				
TIME	ACTUAL	CORRECTED	DIAMETER	PERCENT
(minutes)	READING	READING	(mm)	FINER (%)
2	47.0	41.5	0.0277	48.7
5	42.0	36.5	0.0183	42.8
15	37.5	32.0	0.0110	37.5
30	34.0	28.5	0.0080	33.4
60	31.0	25.5	0.0058	29.9
171	27.5	22.0	0.0035	25.8
1329	23.0	17.5	0.0013	20.5



PARTICLE SIZE DISTRIBUTION TEST REPORT PAGE 2 OF 2

MOISTURE CONTENT DETERMINATION

REPORT FORM

PROJECT:	ORMET-4489		
PROJECT No.:	SE-0218		
SAMPLE No.:	Borrow		
TESTING DATE:	29-Jun-07		
TESTED BY:	RRB		
TRACKING CODE:	4305_MC		

MOISTURE CONTENT (Dry & Wet Basis)						
1. MOISTURE TIN NO.	А		В		С	
2. WT MOISTURE TIN (tare weight)	69.00	g	70.25	g	69.26	g
3. WT WET SOIL + TARE	134.18	g	126.45	g	123.47	g
4. WT DRY SOIL + TARE	129.56	g	122.54	g	119.65	g
5. WT WATER, Ww	4.62	g	3.91	g	3.82	g
6. WT DRY SOIL, Ws	60.56	g	52.29	g	50.39	g
7. ASTM MOISTURE CONTENT	7.63	%	7.48	%	7.58	%
8. PERCENT SOLIDS	92.91	%	93.04	%	92.95	%
9. AVERAGE ASTM MOISTURE CONTENT	7.56	%				
10. AVERAGE PERCENT SOLIDS	92.97	%				

ATTERBERG LIMITS

REPORT FORM ASTM D 4318 (Method B)

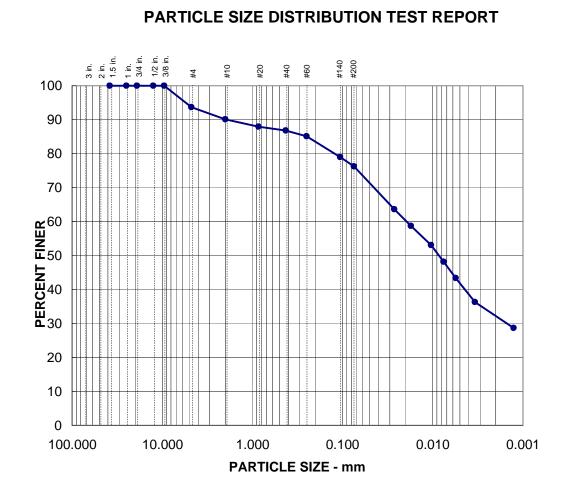
Project:ORMET-4489Testing Date:7/2/2007Project No.:SE-0218Tested By:rrbSample No.:StockpileTracking Code:4304_ATDescription:Dark Brown

Liquid Limit Determination			
Pan No.	Α	В	
Pan Weight	2.20 g	2.17 g	
Wet Soil + Pan	11.03 g	12.37 g	
Dry Soil + Pan	8.47 g	9.35 g	
Wt of Dry Soil, Ws	6.27 g	7.18 g	
Wt of Water, Ww	2.56 g	3.03 g	
Moisture Content, ASTM	40.84 %	42.18 %	
No. of Blows, N	29	29	
Correction Factor, K	1.018	1.018	
Liquid Limit	42	43	

Liquid Limit: 42
Plastic Limit: 19
Plasticity Index: 23

N	k
20	0.974
21	0.979
22	0.985
23	0.990
24	0.995
25	1.000
26	1.005
27	1.009
28	1.014
29	1.018
30	1.022

Plastic Limit Determination			
Pan No.	С	D	
Pan Weight	2.19 g	2.19 g	
Wet Soil + Pan	12.46 g	10.78 g	
Dry Soil + Pan	10.78 g	9.39 g	
Wt of Dry Soil, Ws	8.59 g	7.20 g	
Wt of Water, Ww	1.68 g	1.39 g	
Moisture Content, ASTM	19.56 %	19.31 %	
Plastic Limit	20 %	19 %	



% GRAVEL	% SAND	% SILT	% CLAY
6.3	17 4	34.5	41.8

SAMPLE			
INFORMATION			
Project Name:	ORMET-4489		
Project Number:	SE-0218		
Sample ID:	Stockpile		
Sample Description:	Dark Brown		
Testing Date:	06/29/07		



SAMPLE CLASSIFICATION		
Liquid Limit:	42	
Plastic Limit:	19	
Plasticity Index:	23	
USCS Classification		
Classification	CL	
AASHTO Classification		
Classification	A-7-6	
Group Index	17	
DESCRIPTION:		
Lean Clay with Sand		

PARTICLE SIZE DISTRIBUTION TEST REPORT PAGE 1 OF 2

PARTICLE SIZE DISTRIBUTION DATA REPORT

REPORT FORM ASTM D422

 PROJECT:
 ORMET-4489

 PROJECT No.:
 SE-0218

 SAMPLE No.:
 Stockpile

 SAMPLE DESCRIPT:
 Dark Brown

 TESTING DATE:
 06/29/07

 TESTED BY:
 RRB

 TRACKING CODE:
 4304_GR

MOISTURE CONTENT (DRY AND WET BASIS)			
	229.05 g		
WT WET SOIL + TARE	310.38 g		
WT DRY SOIL + TARE	299.10 g		
WT WATER, Ww	11.28 g		
WT DRY SOIL, Ws	70.05 g		
ASTM MOISTURE	16.10 %		
EPA MOISTURE	13.87 %		

SIEVE NUMBER	PERCENT PASSING
1.5	100.0 %
1.0	100.0 %
0.75	100.0 %
0.5	100.0 %
0.375	100.0 %
#4	93.7 %
#10	90.1 %
#20	87.9 %
#40	86.8 %
#60	85.1 %
#140	79.0 %
#200	76.3 %

HYDROMETER ANALYSIS			
HYDROMETER No. 2			
Wt OF DRY SOIL, Ws	53.44		
DATE TESTING INITIATED	07/02/07		
TIME TESTING INITIATED	10:31:00 AM		

ELAPSED				
TIME	ACTUAL	CORRECTED	DIAMETER	PERCENT
(minutes)	READING	READING	(mm)	FINER (%)
2	51.0	45.5	0.0266	63.6
5	47.5	42.0	0.0174	58.7
15	43.5	38.0	0.0104	53.1
30	40.0	34.5	0.0076	48.2
60	36.5	31.0	0.0055	43.3
170	31.5	26.0	0.0034	36.3
1328	26.0	20.5	0.0013	28.6



PARTICLE SIZE DISTRIBUTION TEST REPORT PAGE 2 OF 2 $\,$

MOISTURE CONTENT DETERMINATION

REPORT FORM

PROJECT:	ORMET-4489
PROJECT No.:	SE-0218
SAMPLE No.:	Stockpile
TESTING DATE:	29-Jun-07
TESTED BY:	RRB
TRACKING CODE:	4304_MC

MOISTURE COI	NTENT (Dry &	Wet	Basis)			
1. MOISTURE TIN NO.	А		В		С	
2. WT MOISTURE TIN (tare weight)	86.78	g	62.31	g	64.47	g
3. WT WET SOIL + TARE	149.59	g	131.92	g	130.64	g
4. WT DRY SOIL + TARE	140.98	g	122.35	g	121.60	g
5. WT WATER, Ww	8.61	g	9.57	g	9.04	g
6. WT DRY SOIL, Ws	54.20	g	60.04	g	57.13	g
7. ASTM MOISTURE CONTENT	15.89	%	15.94	%	15.82	%
8. PERCENT SOLIDS	86.29	%	86.25	%	86.34	%
9. AVERAGE ASTM MOISTURE CONTENT	15.88	%				
10. AVERAGE PERCENT SOLIDS	86.29	%				

MOISTURE-DENSITY RELATIONSHIP TEST

Curve No.:

Project No.: SE-0218

Project: ORMET-4489 Location: KEMRON

Elev/Depth:

Remarks:

MATERIAL DESCRIPTION

Description: Stockpile

Classifications: USCS:

AASHTO:

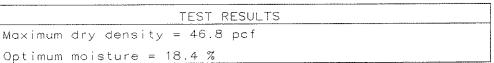
Date: 7/2/2007

Nat. Moist. = %

Sp.G. =

Liquid Limit =

Plasticity Index =



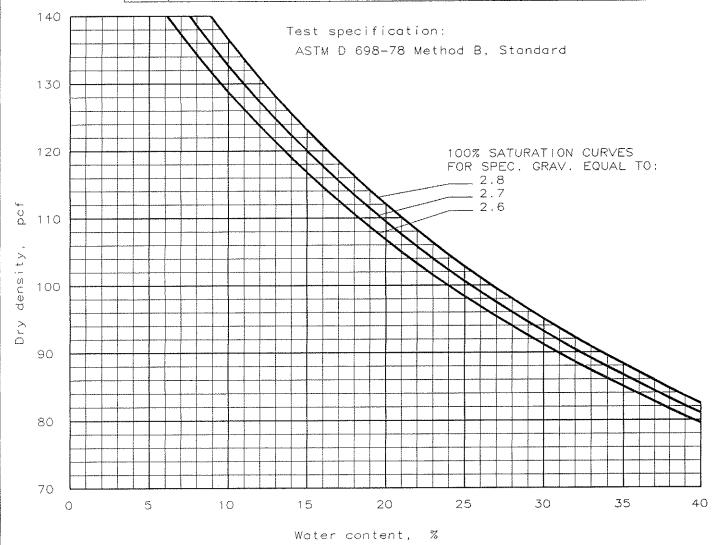


Plate No. 1

_________ MOISTURE-DENSITY TEST DATA DATA FILE: 177

PROJECT DATA

7/2/2007 Date: Project no.: SE-0218 Project: Location 1: ORMET-4489

KEMRON

Remarks 1:

2: 3:

Material 1: Stockpile

description 2:

Elevation or depth: Fig no:

SPECIMEN DATA

AASHTO classification: USCS classification: Specific gravity: Natural moisture:

Percent retained on No.4 sieve:

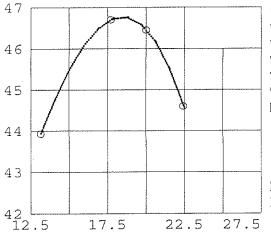
Percent passing No. 200 sieve:

Plastic limit: Plasticity index: Liquid limit:

TEST DATA AND RESULTS

Type of test: Standard, ASTM D 698-78 Method B

1



POINT NO. 1 2 3 4 WM + WS 3914 3902 3735 3940 WM 2043 2043 2043 2043 WW+T #1 1138.50 1278.20 1408.10 1165.30 WD+T #1 1043.30 1136.90 1303.20 1055.20 TARE #1 505.32 506.29 504.07 504.06 MOIST #1 17.7 22.4 13.1 20.0

MOISTURE 17.7 22.4 13.1 20.0 DRY DEN 46.7 44.6 44.0 46.5

Max dry den= 46.8 pcf, Opt moisture= 18.4 %

NOTE (Grismala): Densities appear to be incorrect. Water contents agree with results earlier in this lab report.

_______ ______

MOISTURE-DENSITY RELATIONSHIP TEST

Curve No.:

Project No.: SE-0218

Date: 7/2/2007

Project: ORMET-4489 Location: KEMRON

Elev/Depth: Remarks:

MATERIAL DESCRIPTION

Description: Borrow

Classifications: USCS:

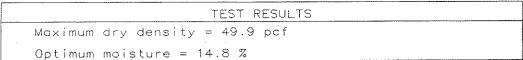
AASHTO:

Nat. Moist. = %

Sp.G. =

Liquid Limit =

Plasticity Index =



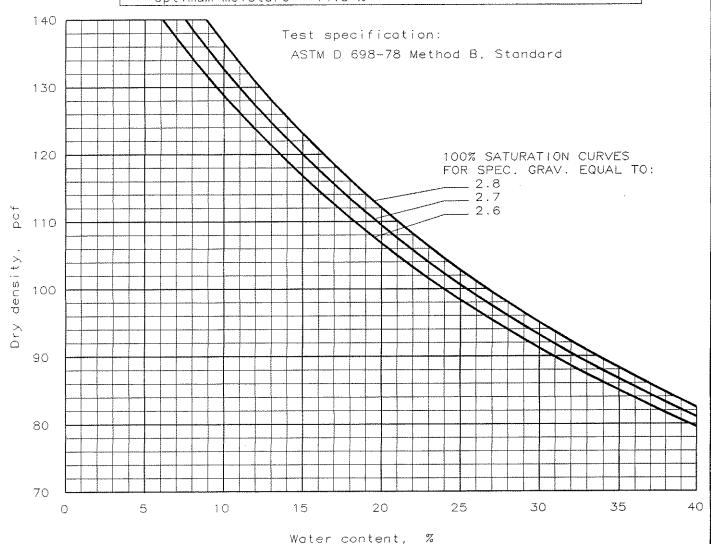


Plate No. 1

MOISTURE-DENSITY TEST DATA DATA FILE: 176

PROJECT DATA

Date: 7/2/2007
Project no.: SE-0218
Project: ORMET-4489

Location 1: KEMRON

2: Remarks 1:

2: 3:

Material 1: Borrow

description 2:

Elevation or depth:

Fig no:

SPECIMEN DATA

USCS classification: AASHTO classification: Natural moisture: Specific gravity:

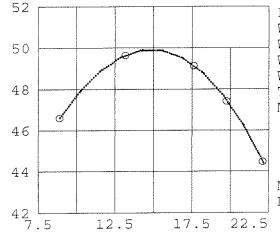
Percent retained on No.4 sieve:

Percent passing No. 200 sieve:

Liquid limit: Plastic limit: Plasticity index:

TEST DATA AND RESULTS

Type of test: Standard, ASTM D 698-78 Method B



POINT NO. 1 2 3 4 5 WM + WS 4011 3892 3977 3956 3772 WM 2043 2043 2043 2043 2043 WW+T #1 1466.10 1310.20 1239.80 1638.10 1489.80 WD+T #1 1322.50 1164.20 1118.30 1506.30 1409.10 TARE #1 506.56 503.05 502.64 504.84 500.08 MOIST #1 17.6 22.1 19.7 13.2 8.9

MOISTURE 17.6 22.1 19.7 13.2 8.9 DRY DEN 49.2 44.5 47.5 49.7 46.7

Max dry den= 49.9 pcf, Opt moisture= 14.8 %

NOTE (Grismala): Densities appear to be incorrect. Water contents agree with results earlier in this lab report.



1359-A Elisworth Industrial Boulevard 🗰 Atlanta, GA 30318 🗯 Telephone (404) 636-0928 🗯 FAX (404) 636-7162 📠 http://www.kemron.com

October 24, 2007

Ralph Grismala, P.E.

ICF International
(860)599-3534 Tel
(860)599-3534 Fax
E-mail: RGrismala@icfi.com

Re:

Borrow Source Certification

Ormet CMSD Landfill Cap Repair

Dear Mr. Grismala,

Please find attached the final analytical results for the Omet borrow material utilized for the repair of the landfill. The analytical requirements for the project were as directed via ICF emails dated 9/14/07 and 9/17/07 stating the analytical methods to be utilized and the compliance criteria to be met.

Please do not hesitate to call me at 404.886.1472 to discuss.

Sincerely,

Michael Riley

Senior Project Manager

Cc:

Steven Reichenbacher, ICF

John Mount, Kemron

NOTE: Only the pages with analytical results are included in this appendix.

LABORATORY REPORT

L0709624

10/08/07 10:38

Submitted By

KEMRON Environmental Services 156 Starlite Drive Marietta , OH 45750 (740) 373 - 4071

For

Account Name: Kemron Environmental Services
1359-A Ellsworth Industrial Blvd

Atlanta, GA 30318

Attention: John Mount

Account Number: 2820
Work ID: ORMET LANDFILL

P.O. Number: SE 4489

Sample Summary

Date Collected Date Received Client ID Lab ID 09/25/2007 09/25/2007 09:40 L0709624-01 SFS

KEMRON FORMS - Modified 11/30/2005 Version 1.5 PDF File ID: 896338 Report generated 10/08/2007 10:38 1 OF 1

Report Number: L0709624

Report Date : October 8, 2007

Sample Number: L0709624-01 Client ID: SFS

Matrix:Soil Workgroup Number: WG251273 Collect Date: 09/25/2007 09:40 Sample Tag:01

PrePrep Method: NONE Prep Method: 5030B Analytical Method: 8015B

Analyst: SMH

Units:ug/kg

Dilution: 1_

____Instrument: HP3 Prep Date: 09/28/2007 15:31 Cal Date: 03/02/2007 16:25 Run Date: 09/28/2007 15:31

File ID:3G28645

Percent Solid: 90.7

Analyte	CAS. Numb	er	Re	sult	Qual		RL.	MI
Gasoline Range Organics	8006-61-				σ		108	48
	% Recovery	Lowe	r	Upper		Oual	April Angles of French Street Street	
Surrogate Chlorobenzene(s)	102	64		148				

U Not detected at or above adjusted sample detection limit

Sample Number: L0709624-01 Client ID: SFS

Matrix: Soil Workgroup Number: WG251242 Collect Date: 09/25/2007 09:40 Sample Tag:01

PrePrep Method: NONE Prep Method: 3051 Analytical Method: 6020

Analyst:JYH Units:mg/kg

Instrument: ELAN-ICP

Prep Date: 09/26/2007 13:00 Cal Date: 09/28/2007 10:25 Run Date: 09/28/2007 18:40 File ID:EL.092807.184004

Percent Solid:90.7

Analyte	CAS. Number	Result	Qual	RL	MDL	
	7440-38-2	7.51		0.328	0.0820	
Arsenic, Total		I	<u> </u>		·······	

Sample Number: L0709624-01 Client ID:SFS

Matrix: Soil Workgroup Number: WG251363

Collect Date: 09/25/2007 09:40 Sample Tag:02

PrePrep Method: NONE Prep Method: 3550B Analytical Method: 8081A

Analyst: ECL Dilution:1 Units:ug/kg

Instrument: HP15

Prep Date: 09/27/2007 08:00 Cal Date: 08/15/2007 17:15 Run Date: 09/28/2007 22:31

File ID: 15G11553.R Percent Solid: 90.7

					and the second second			
Analyte	CAS. Numb	er	Re	sult	Qual	ĺ .	RL	MDL
beta-BHC	319-85-7		0	.768	J		1.79	0.357
						O-1-0-1]	
Surrogate	% Recovery	Lowe	:r	Uppe:		Qual		
2,4,5,6-Tetrachloro-m-xylene	90.8	39		130				
Decachlorobiphenyl	141	33	MANUSCO PO TOTO COMP	143		**************************************		

J The analyte was positively identified, but the quantitation was below the RL

Sample Number: L0709624-01 Client ID: SFS

Matrix:Soil Workgroup Number: WG251363 Collect Date: 09/25/2007 09:40 Sample Tag: 01

PrePrep Method: NONE Prep Method:3550B Analytical Method: 8081A Analyst: ECL

Instrument: HP15 Prep Date: 09/27/2007 08:00 Cal Date: 08/15/2007 17:15 Run Date: 09/28/2007 22:03 File ID: 15G11553.F

Dilution: 1 Percent Solid:90.7 Units:ug/kg

Analyte	CAS. Number	Result	Qual	RL	MDL
alpha-BHC	319-84-6		U	1.79	0.357
delta-BHC	319-86-8		υ	1.79	0.357
gamma-BHC (Lindane)	58-89-9		U	1.79	0.357
Heptachlor	76-44-8		ਹ	1.79	0.357
Aldrin	309-00-2		ש	1.79	0.357
Heptachlor epoxide	1024-57-3		ש	1.79	0.357
Endosulfan I	959-98-8		υ	1.79	0.357
Endosulian 1	333-30-0				J

. 1 of.

Report Number: L0709624

Report Date : October 8, 2007

Instrument: HP15 PrePrep Method: NONE Sample Number: L0709624-01 Prep Date: 09/27/2007 08:00 Client ID: SFS Prep Method:3550B Cal Date: 08/15/2007 17:15 Analytical Method: 8081A Matrix: Soil Run Date: 09/28/2007 22:03 Analyst: ECL Workgroup Number: WG251363 File ID: 15G11553.F Dilution: 1 Collect Date: 09/25/2007 09:40 Units:ug/kg Percent Solid: 90.7 Sample Tag: 01

Analyte	CAS. Numbe	er I	Result	Qual		RL.	MDL
Dieldrin	60-57-1			U		1.79	0.357
4,4'-DDE	72-55-9			σ	T	1.79	0.357
Endrin	72-20-8			ט		1.79	0.357
Endosulfan II	33213-65-	9		σ		1.79	0.357
4.4'-DDD	72-54-8			U		1.79	0.357
Endosulfan sulfate	1031-07-8	3		ซ		1.79	0.357
4,4'-DDT	50-29-3			U		1.79	0.357
Methoxychlor	72-43-5			ט		1.79	0.357
Endrin ketone	53494-70-	5		υ		1.79	0.357
Endrin aldehyde	7421-93-6	1		σ		1.79	0.357
alpha Chlordane	5103-71-9	9		ซ		1.79	0.357
gamma Chlordane	5103-74-2	2		σ		1.79	0.357
Toxaphene	8001-35-2	2		ΰ		35.7	18.1
Surrogate	% Recovery	Lower	Upj	er.	Qual		
2,4,5,6-Tetrachloro-m-xylene	95.6	39	1:	30	<u> </u>		
Decachlorobiphenyl	94.8	33	1.	43			

U Not detected at or above adjusted sample detection limit

Sample Number:L0709624-01 Client ID:SFS Matrix:Soil Workgroup Number:WG251209 Collect Date:09/25/2007 09:40 Sample Tag:01	PrePrep Method:NONE Prep Method:MBTH Analytical Method:7471 Analyst:SLP Dilution:1 Units:mg/k	OD A	Cal Da Run Da File ID:	nt:HYDRA te:09/26/20 te:09/27/20 te:09/27/20 HY.092707.1 Solid:90.7	07 09:00 07 10:02 00232
Analyte	CAS. Number	Result	Qual	RL_	MDL
Mercury, Total	7439-97-6	0.0205	J	0.270	0.0108

J The analyte was positively identified, but the quantitation was below the RL

PrePrep Method: NONE Instrument: IRIS-ICP Sample Number: L0709624-01 Prep Method: 3050B Prep Date: 09/27/2007 05:40 Client ID:SFS Cal Date: 09/28/2007 08:48
Run Date: 09/28/2007 12:31 Analytical Method: 6010B Matrix:Soil Analyst:KHR Workgroup Number: WG251257 File ID: IR.092807.123100 Dilution: 1 Collect Date: 09/25/2007 09:40 Percent Solid: 90.7 Units:mg/kg Sample Tag: 01

Analyte	CAS. Number	Result	Qual	RL	MDL
Silver, Total	7440-22-4	0.679	J	1.64	0.206
Barium, Total	7440-39-3	208		0.411	0.0822
Cadmium, Total	7440-43-9	0.310	J	0.411	0.0411
Chromium, Total	7440-47-3	22.1		0.822	0.0987
Lead, Total	7439-92-1	16.7		4.11	0.411

J The analyte was positively identified, but the quantitation was below the RL

2 of 7

Report Number: L0709624

Matrix:Soil

Workgroup Number: WG251257

Report Date : October 8, 2007

Sample Number: L0709624-01 Client ID: SFS

PrePrep Method: NONE Prep Method: 3050B Analytical Method: 6010B Analyst: KHR

Prep Date: 09/27/2007 05:40 Cal Date: 09/28/2007 08:48 Run Date: 09/28/2007 15:11 File ID: IR. 092807.151100 Percent Solid: 90.7

Instrument: IRIS-ICP

Collect Date: 09/25/2007 09:40 Units:mg/kg Sample Tag: DL01

3 - 1 - b 4	CAS. Number	Result	Qual	RL	MDL
Analyte	7782-49-2		Ħ	4.11	2.06
Selenium, Total	1/82-43-2				

Dilution:5

U Not detected at or above adjusted sample detection limit

Sample Number: L0709624-01 Client ID: SFS Matrix:Soil Workgroup Number: WG251432 Collect Date: 09/25/2007 09:40

PrePrep Method: NONE Prep Method: D2216-90 Analytical Method: D2216-90 Analyst:DIH Dilution: 1 Units:weight %

Instrument: OVEN Prep Date: 09/28/2007 15:45 Run Date: 09/28/2007 15:45 File ID: OV. 0709281545-01

N — - 7 a.s.b	CAS Number	Result C	ual	RL	MDL
Analyte	10-02-6	90.7		1.00	1.00
Percent Solids		L			

Sample Number: L0709624-01 Client ID: SFS Matrix: Soil Workgroup Number: WG251364 Collect Date: 09/25/2007 09:40 Sample Tag: 01

PrePrep Method: NONE Prep Method: 3550B Analytical Method: 8082 Analyst: ECL Dilution: 1 Units:ug/kg

Instrument: HP9 Prep Date: 09/27/2007 08:00 Cal Date: 09/19/2007 15:09 Run Date: 09/28/2007 17:05 File ID: 9GR42800.R Percent Solid: 90.7

**************************************	CAS. Numbe	r	Result	Qual		RL	MDL
Analyte Aroclor-1016	12674-11-			ט		17.9	8.93
	11104-28-	2		Ū		17.9	8.93
Aroclor-1221	11141-16-			Ū	1	17.9	8.93
Aroclor-1232	53469-21-			U	-	17.9	8.93
Aroclor-1242			60.4			17.9	8.93
Aroclor-1248	12672-29-		00.4	 0		17.9	8.93
Aroclor-1254	1109769-						8.93
Aroclor-1260	11096-82-	5		<u>ט</u>	,	17.9	0.93
Surrogate	% Recovery	Lower	·······	per	Qual	-	
2,4,5,6-Tetrachloro-M-Xylene	96.8	29		33		-	
Decachlorobiphenyl	137	30	1	73]	

U Not detected at or above adjusted sample detection limit

Report Number: L0709624

Report Date : October 8, 2007

Sample Number:<u>L0709624-01</u>
Client ID:<u>SFS</u>
Matrix:<u>Soil</u>

Workgroup Number: WG251379

Collect Date: 09/25/2007 09:40

Sample Tag: 01

PrePrep Method: NONE

Prep Method:3545 Analytical Method:8015B Analyst:HAV

Dilution: 1 Units:ug/kg Instrument:HP14

Prep Date: 09/27/2007 08:00 Cal Date: 08/20/2007 12:04 Run Date: 09/29/2007 16:45

File ID: 14G18283.R Percent Solid: 90.7

Analyte	CAS. Numb		Result	Qual		RL	MDL
Diesel Range (C10-C28)	68334-30-	5	5510	J	1	0900	2710
Surrogate	% Recovery	Lower	Uppe	r	Qual		
o-Terphenyl	70.9	43	136				
Octacosane	73.7	25	162				

J The analyte was positively identified, but the quantitation was below the RL

Sample Number:L0709624-01
Client ID:SFS
Matrix:Soil
Workgroup Number:WG251394

kgroup Number: WG251394 Collect Date: 09/25/2007 09:40 Sample Tag: 01 PrePrep Method:NONE
Prep Method:3545
Analytical Method:8270C
Analyst:CAA
Dilution:1

Units:ug/kg

Instrument:HPMS4

Prep Date:09/27/2007 08:00

Cal Date:09/24/2007 13:35

Run Date:09/28/2007 19:38

File ID:4M39484

Percent Solid: 90.7

Analyte	CAS. Number	Result	Qual	RL	MDL
Phenol	108-95-2		σ	180	90.2
Bis(2-Chloroethyl)ether	111-44-4		ט	180	90.2
2-Chlorophenol	95-57-8		Ū	180	90.2
1.3-Dichlorobenzene	541-73-1		U	180	90.2
1.4-Dichlorobenzene	106-46-7		Ū	180	90.2
Benzyl alcohol	100-51-6		Ū	180	90.2
1.2-Dichlorobenzene	95-50-1		ט	180	90.2
2-Methylphenol	95-48-7		ΰ	180	90.2
34-Methylphenol	106-44-5		σ	180	90.2
bis (2-Chloroisopropyl) ether	39638-32-9		ט	180	90.2
N-Nitrosodipropylamine	621-64-7		Ü	180	90.2
Hexachloroethane	67-72-1		Ū	180	90.2
Nitrobenzene	98-95-3		υ	180	90.2
Isophorone	78-59-1		U	180	90.2
2-Nitrophenol	88-75-5		σ	180	90.2
2.4-Dimethylphenol	105-67-9		υ	180	90.2
Benzoic acid	65-85-0		ש	902	361
Bis (2-Chloroethoxy) Methane	111-91-1		ט	180	90.2
2,4-Dichlorophenol	120-83-2		ט	180	90.2
1,2,4-Trichlorobenzene	120-82-1		ט	180	90.2
Naphthalene	91-20-3		σ	180	90.2
4-Chloroaniline	106-47-8		U	180	90.2
Hexachlorobutadiene	87-68-3		ט	180	90.2
4-Chloro-3-methylphenol	59-50-7		ט	180	90.2
2-Methylnaphthalene	91-57-6		ט	180	90.2
Hexachlorocyclopentadiene	77-47-4		U	180	90.2
2,4,6-Trichlorophenol	88-06-2		σ	180	90.2
2,4,5-Trichlorophenol	95-95-4		υ	180	90.2
2-Chloronaphthalene	91-58-7		ซ	180	90.2
2-Nitroaniline	88-74-4		ซ	902	361
Dimethylphthalate	131-11-3		ט	180	90.2
Acenaphthylene	208-96-8		Ū	180	90.2
2,6-Dinitrotoluene	606-20-2		ט	180	90.2
3-Nitroaniline	99-09-2		σ	902	361

1 of 7

Report Number: L0709624

Report Date : October 8, 2007

Instrument: HPMS4 PrePrep Method: NONE Sample Number: L0709624-01 Prep Date: 09/27/2007 08:00
Cal Date: 09/24/2007 13:35 Prep Method: 3545 Client ID: SFS Analytical Method: 8270C Matrix: Soil Run Date: 09/28/2007 19:38 Analyst: CAA Workgroup Number: WG251394

File ID:4M39484 Dilution: 1 Collect Date: 09/25/2007 09:40 Percent Solid: 90.7 Units:ug/kg Sample Tag:01

Analyte	CAS. Numbe	r R	lesult	Qual	RL	MDL
Acenaphthene	83-32-9			บ	180	90.2
2,4-Dinitrophenol	51-28-5			υ	902	361
4-Nitrophenol	100-02-7			υ	902	361
Dibenzofuran	132-64-9		·	U	180	90.2
2.4-Dinitrotoluene	121-14-2			ט	180	90.2
Diethylphthalate	84-66-2			U	180	90.2
4-Chlorophenyl-phenyl ether	7005-72-3			U	180	90.2
Fluorene	86-73-7			υ	180	90.2
4-Nitroaniline	100-01-6			บ	902	361
4,6-Dinitro-2-methylphenol	534-52-1			υ	902	361
N-Nitrosodiphenylamine	86-30-6			U	180	90.2
4-Bromophenyl-phenylether	101-55-3			U	180	90.2
Hexachlorobenzene	118-74-1			ט	180	90.2
Pentachlorophenol	87-86-5			U	902	361
Phenanthrene	85-01-8		161	J	180	90.2
Anthracene	120-12-7			ΰ	180	90.2
Di-N-Butylphthalate	84-74-2			Ū	180	90.2
Fluoranthene	206-44-0		469		180	90.2
Pyrene	129-00-0		410		180	90.2
Butylbenzylphthalate	85-68-7			σ	180	90.2
3.3'-Dichlorobenzidine	91-94-1			U	361	180
Benzo(a) anthracene	56-55-3		315		180	90.2
Chrysene	218-01-9	•	384		180	90.2
bis (2-Ethylhexyl) phthalate	117-81-7	·		Ų	180	90.2
Di-n-octylphthalate	117-84-0)	100	σ	180	90.2
Benzo(b) fluoranthene	205-99-2	2	429		180	90.2
Benzo(k) fluoranthene	207-08-5	9	341		180	90.2
Benzo(a) pyrene	50-32-8		377		180	90.2
Indeno(1,2,3-cd)pyrene	193-39-	5	258		180	90.2
Dibenzo(a,h)Anthracene	53-70-3			Ū	180	90.2
Benzo(g,h,i)Perylene	191-24-	2	278		180	90.2
Surrogate	% Recovery	Lower	Uppe		Qual	
2-Fluorophenol	49.8	25	121			
Phenol-d5	55.0	24	113			
Nitrobenzene-d5	54.6	23	120)		
2-Fluorobiphenyl	56.3	30	115	5		
2,4,6-Tribromophenol	74.9	19	122	2		
p-Terphenyl-d14	92.0	18	137	!	<u>i </u>	

U Not detected at or above adjusted sample detection limit J The analyte was positively identified, but the quantitation was below the RL

Report Number: L0709624

Report Date : October 8, 2007

Sample Number: L0709624-01

Client ID: SFS

Matrix: Soil
Workgroup Number: WG251239
Collect Date: 09/25/2007 09:40

Sample Tag: 01

PrePrep Method: NONE

Prep Method: 5030B Analytical Method: 8260B

Analyst:MES
Dilution:1

Units:ug/kg

Instrument: HPMS9
Prep Date: 09/27/2007 15:51
Cal Date: 08/14/2007 16:27

Run Date: 09/27/2007 15:51

File ID:9M57031

Percent Solid: 90.7

Analyte	CAS. Number	Result	Qual	RL	WDL
Acetone	67-64-1	<u> </u>	υ	10.5	5.26
Benzene	71-43-2		σ	5.26	0.526
Bromobenzene	108-86-1		Ü	5.26	0.526
Bromochloromethane	74-97-5		ū	5.26	0.526
Bromodichloromethane	75-27-4		Ū	5.26	0.526
Bromoform	75-25-2	ļ	Ū	5.26	0.526
Bromomethane	74-83-9		ช	10.5	1.05
2-Butanone	78-93-3		ប	10.5	2.63
n-Butylbenzene	104-51-8		ט	5.26	0.526
sec-Butylbenzene	135-98-8		υ	5.26	0.526
tert-Butylbenzene	98-06-6		ซ	5.26	0.526
Carbon disulfide	75-15-0	1	ū	5.26	0.526
Carbon tetrachloride	56-23-5		ט	5.26	0.526
Chlorobenzene	108-90-7		ט	5.26	0.526
Chlorodibromomethane	124-48-1	:	Ū	5.26	0.526
Chloroethane	75-00-3		ט	10.5	1.05
2-Chloroethyl vinyl ether	110-75-8		Ū	10.5	2.10
Chloroform	67-66-3	i	Ū	5.26	0.526
Chloromethane	74-87-3	<u> </u>	U	10.5	2.10
2-Chlorotoluene	95-49-8	1	Ū	5.26	0.526
	106-43-4		U	5.26	0.526
4-Chlorotoluene	96-12-8		·σ	5.26	2.10
1,2-Dibromo-3-chloropropane	1.06-93-4		י די	5.26	0.526
1,2-Dibromoethane	74-95-3		U	5.26	0.526
Dibromomethane	95-50-1		ן ט	5.26	0.526
1,2-Dichlorobenzene	541-73-1		יס ו	5.26	0.526
1,3-Dichlorobenzene	106-46-7		ט	5.26	0.526
1,4-Dichlorobenzene	75-71-8		י ט	10.5	1.05
Dichlorodifluoromethane	75-34-3		- 	5,26	1.05
1,1-Dichloroethane	107-06-2		- - 	5.26	0.526
1,2-Dichloroethane	75-35-4			5.26	0.526
1,1-Dichloroethene	156-59-2		- "	5.26	0.526
cis-1,2-Dichloroethene	156-60-5		- 	5.26	0.526
trans-1,2-Dichloroethene	78-87-5		- 0	5.26	0.526
1,2-Dichloropropane	142-28-9			5.26	0.526
1,3-Dichloropropane	594-20-7		7	5.26	0.526
2,2-Dichloropropane	10061-01-5		, U	5.26	0.526
cis-1,3-Dichloropropene				5.26	0,526
trans-1,3-Dichloropropene	10061-02-6		ט ט	5.26	0.526
1,1-Dichloropropene	563-58-6		ט	5.26	0.526
Ethylbenzene	100-41-4		<u>ס</u>	10.5	2.63
2-Hexanone	591-78-6	<u> </u>		5.26	0.526
Hexachlorobutadiene	87-68-3		TO TO	5.26	0.526
Isopropylbenzene	98-82-8		TI U	5.26	0.526
p-Isopropyltoluene	99-87-6			10.5	2,63
4-Methyl-2-pentanone	108-10-1			5.26	1.05
Methylene chloride	75-09-2		ū		0.526
Naphthalene	91-20-3		<u>U</u>	10.5	0.526
n-Propylbenzene	103-65-1	<u> </u>	υ	5.26	0.526

ο£

Report Number: L0709624

Report Date : October 8, 2007

PrePrep Method: NONE Instrument: HPMS9

Sample Number: L0709624-01 Client ID: SFS Prep Method: 5030B Analytical Method: 8260B Prep Date: 09/27/2007 15:51 Cal Date: 08/14/2007 16:27 Matrix: Soil Run Date: 09/27/2007 15:51 Workgroup Number: WG251239
Collect Date: 09/25/2007 09:40 Analyst: MES Dilution: 1

File ID:9M57031
Percent Solid:90.7 Units:ug/kg Sample Tag: 01

Analyte	CAS. Numbe	r R	esult	Qual		RI.	MDL
Styrene	100-42-5			σ		5.26	0.526
1,1,1,2-Tetrachloroethane	630-20-6			σ		5.26	0.526
1,1,2,2-Tetrachloroethane	79-34-5			υ		5.26	0.526
Tetrachloroethene	127-18-4			U		5.26	0.526
Toluene	108-88-3			υ		5.26	0.526
1.2.3-Trichlorobenzene	87-61-6			Ū		5.26	0.526
1.2.4-Trichlorobenzene	120-82-1		*****	ប		5.26	0.526
1,1,1-Trichloroethane	71-55-6			ט		5.26	0.526
1,1,2-Trichloroethane	79-00-5			บ		5.26	0.526
Trichloroethene	79-01-6			Ū	ļ.	5.26	0.526
Trichlorofluoromethane	75-69-4		············	Ū		10.5	1.05
1,2,3-Trichloropropane	96-18-4		***************************************	ΰ		5.26	1.05
1,2,4-Trimethylbenzene	95-63-6			Ü	1	5.26	0.526
1,3,5-Trimethylbenzene	108-67-8			U		5.26	0.526
Vinyl acetate	108-05-4			ΰ	į	10.5	1.05
Vinyl chloride	75-01-4			Ū	ī	10.5	1.05
o-Xylene	95-47-6			Ū	1	5.26	0.526
m-,p-Xylene	136777-61	-2	<u>,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,</u>	บ		5.26	0.526
m-,p-xylene Surrogate	% Recovery	Lower	raU		Qual		
Dibromofluoromethane	106	80	1.3	20]	
1.2-Dichloroethane-d4	94.8	80	1.	20		Ī	
Toluene-d8	105	81	1:	17	1	j	
4-Bromofluorobenzene	96.5	74	1.	21.	1	1	

U Not detected at or above adjusted sample detection limit



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August 22, 2007

Steven J. Reichenbacher ICF International (781) 676-4079 Tel (339) 206-9095 Cell (781) 676-4005 Fax

E-mail: sreichenbacher@icfi.com

Re: Density Testing Results

Failed Area Backfill Completed 8-15-07 Ormet CMSD Landfill Cap Repair

Dear Mr. Reichenbacher,

Please find attached the Density Testing Results as performed on 15 August 2007 for the backfill that occurred within the failed area of the slope below the upper diversion berm.

Please do not hesitate to call me at 404.242.5837 to discuss if you require any additional information for these materials.

Sincerely,

Michael Riley Senior Project Manager

Cc: Ralph Grismala, ICF John Mount, Kemron



FIELD ACTIVITY DAILY LOG

PROJECT NAME: ORMET LANDFILL			PROJECT No. 2007-343-01	
CLIENT NAME: KEMRON ENVIRONMENTAL		CLIENT CONTACT: I	MIKE RILEY	
LOCATION OF SITE/ADDRESS: HANNIBAL, OHIO	·	DATE: AUGUST 15, 2	2007	
		TIME(S) ON SITE: 11:40 AM-3:00 PM		
GEOTECHNICS FIELD REPRESENTATIVE: PATRICK CUMMINGS		OTHER GEOTECHNIC	CS PERSONNEL ON SITE: NA	
CONTRACTOR: KEMRON ENVIRONMENTA	L	GENERAL CONTRAC	TOR'S REP.: MIKE RILEY	
SPECIALTY CONTRACTOR: NA	77 - 1844-9-184 L	SPECIALTY CONTRA	CTOR'S REP. (FOREMAN/SUPT.): NA	
Visitors	AND OTHER FIRM	(s) Represented	On Site:	
FIRM NAME	REPRESENTATIVI	E'S TITLE	REPRESENTATIVE'S NAME	
WEATHER CONDITIONS: SUNNY			TEMPERATURE: 85	
FIELD ACTIVITY SUBJECT(S): BACKFILL C	COMPACTION			
CONTRACTOR'S EQUIPMENT: DOZER-TRU	JCK-SELF PROPELLED S	HEEPS FOOT COMPACT	OR	
On SITE LOCATION OF WORK: SEE DENS	тү Ѕкетсн			
CHANGES FROM PLANS AND SPECIFICATIO None See Descriptions of Daily Act			RTANT DECISIONS:	
IMPORTANT TELEPHONE CALLS: None See Descriptions of Daily Act	ivities and Events, Iten	n Numbers:		
DESCRIPTION OF DAILY ACTIVI	TIES AND EVENT	TS:	- 11 11 11 11 11 11 11 11 11 11 11 11 11	
Patrick Cummings arrived on site a	t 11:40 am and me	t with Mike Riley o	of Kemron Environmental.	
_		•		
Based on information from Mike				
gauge. The material used for back				
was then end dumped and spread			-	
propelled sheeps foot compactor. sketch of the test locations. The pr			suits are attached along with a	
Patrick Cummings left the site at 3:	:00 pm.			
	Cummings left the site at 3:00 pm.			
those operations, and report those opinions to o	our client. The presence of the	ne Geotechnics representat	identified, form opinions about the adequacy of ive does not relieve the contractor's obligation to	
meet contractual requirements. The contractor report is provided solely as evidence that field of		site safety and the metho	ds and sequences of construction. A preliminary	

DATE:

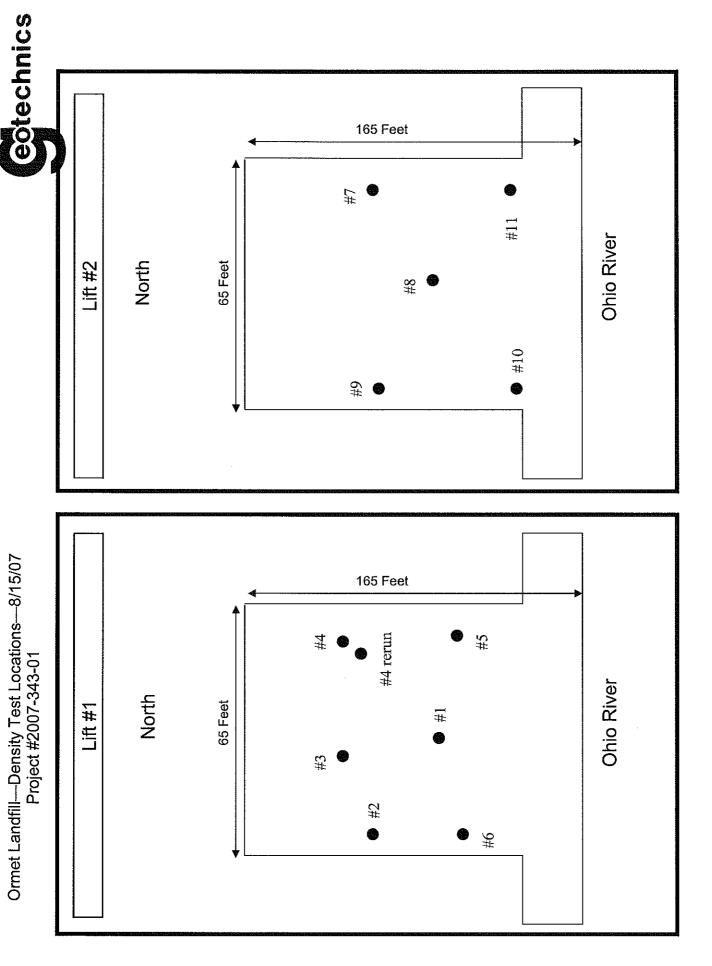
August 15, 2007

Field Representative: Patrick Cummings

NUCLEAR DENSITY TEST REPORT



Project Name:	me:		Ormet Landfill	-andfill	Andrew Commence and the commence and the		Project #:	2007-343-01	Date:	8/15/07
Client Name;	Эе:		Kemron Env	Environmental			Tested by:	PC	Report #:	-
Location:			Hannibal, Ohio	ıl, Ohio			Gauge #:	13957	Model:	3401B
Client Contact:	tact:		Mike Riley	Riley			Density Count	2483	Moisture Count	574
Dě	Density Standards	ards	Material Description	tion	Proc	Proctor ID	Maximum Dry Density (pcf)	Optimum Moisture	Compaction Requirements	ction ments
	ASTM D698	8	Stockpile		Performed	Performed by Others	105.3	18.4	85%	9
			Brown lean clay with rock fragments	fragments						
Test#	Proctor ID		Test Location	Lift	Depth Tested	Wet Density	Dry Density	Moisture (%)	Compaction (%)	Pass/Fail
~-	Stockpile	1st Lift, S	1st Lift, See Attached Sketch	.8	9	122.6	104.5	18.1	99.2	Pass
2	Stockpile	1st Liff, S	1st Lift, See Attached Sketch	* &	6"	124.7	108.0	16.7	105.5	Pass
3	Stockpile	1st Lift, S	1st Liff, See Attached Sketch	8	6"	111.3	0.96	15.3	91.1	Pass
4	Stockpile	1st Lift, S	1st Lift, See Attached Sketch	8	6"	8'96	82.8	14.0	78.6	Fail
5	Stockpile	1st Lift, S	1st Lift, See Attached Sketch	8	6"	105.9	88.9	17.0	84.4	Fail
9	Stockpile	1st Lift, S	1st Lift, See Attached Sketch	.8	.9	111.4	95.3	16.2	90.5	Pass
		Rerun of	Rerun of #4 after compaction.							
4	Stockpile	1st Lift, S	1st Lift, See Attached Sketch	8	9	111.3	94.2	17.1	89.4	Pass
7	Stockpile	2nd Lift, \$	2nd Lift, See Attached Sketch	8	9	127.1	107.2	19.9	101.8	Pass
8	Stockpile	2nd Lift, \$	2nd Lift, See Attached Sketch	8"	"9	122.4	101.9	20.5	2.96	Pass
6	Stockpile	2nd Lift, \$	2nd Lift, See Attached Sketch	8"	9	125.7	105.6	20.1	100.2	Pass
10	Stockpile	2nd Lift, \$	2nd Lift, See Attached Sketch	8	9	118.5	101.9	16.7	2.96	Pass
11	Stockpile	2nd Lift, 9	2nd Lift, See Attached Sketch	8	9	131.7	110.7	21.0	105.1	Pass
Field Representative	esentative		Date			Compact	Compaction Methods/ Equipment/Comments	ipment/Commen	ts	
Pa	Patrick Cummings	sbui	8/15/07	The ma	aterial was e	and dumped	The material was end dumped by truck, spread in 8 inch loose lifts with a dozer and then	n 8 inch loose lift	s with a dozer a	and then
Reviewed By Ran	d By Randy O'Rourke		Date 8/17/2007		3	ilipacieu wi	compacted with a sell propelled sneepsloot compactor	si eepsiool colli	paciul .	





DATE: September 18, 2007

FIELD ACTIVITY DAILY LOG

CLIENT NAME: KEMRON ENVIRONMENTAL LOCATION OF SITE/ADDRESS: HANNIBAL, OHIO GEOTECHNICS FIELD REPRESENTATIVE: DAN ABARAY CONTRACTOR: KEMRON ENVIRONMENTAL SPECIALTY CONTRACTOR: NA	OTHER GEOTE	
HANNIBAL, OHIO GEOTECHNICS FIELD REPRESENTATIVE: DAN ABARAY CONTRACTOR: KEMRON ENVIRONMENTAL	TIME(S) ON SIT	те: 11:00 ам-3:00 рм
Dan Abaray Contractor: Kemron Environmental	OTHER GEOTE	
Dan Abaray Contractor: Kemron Environmental		CHNICS PERSONNEL ON SITE: NA
	GENERAL CON	
SPECIALTY CONTRACTOR: NA		TRACTOR'S REP.: MIKE RILEY
SIEGALII CONTRACTOR 101	SPECIALTY CO	NTRACTOR'S REP. (FOREMAN/SUPT.): NA
VISITORS AND OTHE	r Firm(s) Represen	TED ON SITE:
FIRM NAME REPRESEN	TATIVE'S TITLE	REPRESENTATIVE'S NAME
WEATHER CONDITIONS: SUNNY, CLEAR		TEMPERATURE: 85
FIELD ACTIVITY SUBJECT(S): BACKFILL COMPACTION		
``		
CONTRACTOR'S EQUIPMENT: DOZER-TRUCK-SELF PROI	PELLED SHEEPS FOOT COM	IPACTOR
•		
ON SITE LOCATION OF WORK: SEE DENSITY SKETCH		
CHANGES FROM PLANS AND SPECIFICATIONS, AND OTHE None See Descriptions of Daily Activities and Even		
IMPORTANT TELEPHONE CALLS:		
None See Descriptions of Daily Activities and Evo	ents, Item Numbers:	1 / 1 / 1
DESCRIPTION OF DAILY ACTIVITIES AND	EVENTS:	
Dan Abaray arrived on site at 11:00 am and me	et with Kevin of Kem	ron Environmental.
Ž		
Based on information from Kevin in-place de	ensity tests were perfe	ormed with a Troxler 3430 Nuclear
gauge. According to site personnel, the mat	- ~	
placed in a truck. The material was then end of		
was then compacted with a self propelled she		
~	*	•
with a sketch of the test locations. The procter	resums were provided	t by Ixeviii.
Please note that Dan was not on site to observ	ve the placement of t	he fill. These test results should be
reviewd by the site engineer in regard to the pro-	*	ile iii. These test results should be
Dan Abaray left the site at 3:00 pm.		
NOTICE: The Geotechnics representative is on site solely to ob-	serve operations of the contra	ctor(s) identified form opinions about the adequacy of
those operations, and report those opinions to our client. The pre	,	• • • • • • • • • • • • • • • • • • • •

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report is provided solely as evidence that field observation was performed.

Field Representative: Dan Abaray

NUCLEAR DENSITY TEST REPORT



Project Name:	me:		Ormet Landfill	andfill.			Project #:	2007-343-02	Date:	9/18/07
Client Name:	le:		Kemron Environmental	ironmental			Tested by:	DA	Report #:	_
Location:			Hannibal, Ohio	ıl, Ohio			Gauge #:	22446	Model:	3401B
Client Contact:	tact:		Mike Riley	Riley			Density Count	2546	Moisture Count	648
De	Density Standards	sp.	Material Description	tion	Proct	Proctor ID	Maximum Dry Density (pcf)	Optimum Moisture	Compaction Requirements	ction ments
	ASTM D698		Stockpile		Performed	Performed by Others	105.3	18.4	85%	9
			Brown lean clay with rock	with rock fragments						
Test#	Proctor ID		Test Location		Depth Tested	Wet Density	Dry Density	Moisture (%)	Compaction (%)	Pass/Fail
_	Stockpile		See Sketch		8	122.7	107.8	13.8	102.4	Pass
2	Stockpile		See Sketch	8	8"	110.6	95.3	16.0	90.5	Pass
8	Stockpile		See Sketch	 8	8	121.9	107.9	13.0	102.5	Pass
4	Stockpile		See Sketch	*8	.8	121.8	107.2	13,6	101.8	Pass
5	Stockpile		See Sketch	 	8.,	107.9	94.1	14.6	89.4	Pass
9	Stockpile		See Sketch	.‰	8	125.1	114.0	9.7	108.3	Pass
2	Stockpile		See Sketch	8	8	109.3	98.3	11.2	93.4	Pass
8	Stockpile		See Sketch	 	8	100.6	7.68	12.1	85.2	Pass
6	Stockpile		See Sketch	8	8	121.4	108.4	12.0	102.9	Pass
10	Stockpile		See Sketch	8	8	129.0	115.0	12.2	109.2	Pass
11	Stockpile		See Sketch	8	8	114.8	101.8	12.8	96.7	Pass
12	Stockpile		See Sketch	8	8	133.7	118.3	13.1	112.3	Pass
13	Stockpile		See Sketch		8"	110.7	98.4	12.5	93.3	Pass
14	Stockpile		See Sketch	₩	8	119.9	104.4	14.9	99.1	Pass
Field Representative	esentative		Date			Compact	Compaction Methods/ Equipment/Comments	ipment/Comment	S	
	Dan Abaray		9/18/07	Them	aterial was e	and dumped	The material was end dumped by truck, spread in 8 inch loose lifts with a dozer and then	n 8 inch loose lift	s with a dozer a	and then
Reviewed By Ran	1 By Randy O'Rourke	9)	Date 10/1/2007		3	прастед ул	compacted with a seil propelled sneepsloot compactor.	sneepsiooi com	oactol.	
			And the second s							

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9-18-07 KemRON - Ormet Plant

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River



FIELD ACTIVITY DAILY LOG

PROJECT NAME: ORMET LANDFILL			PROJECT No. 2007-343-02
CLIENT NAME: KEMRON ENVIRONME	NTAL	CLIENT CONTA	CT: KEVIN
LOCATION OF SITE/ADDRESS: HANNIBAL, OHIO	-	DATE: SEPTEME	BER 21, 2007 E: 11:00 AM-3:00 PM
GEOTECHNICS FIELD REPRESENTATI DAN ABARAY	***************************************		CHNICS PERSONNEL ON SITE: NA
CONTRACTOR: KEMRON ENVIRONMI	ENTAL	GENERAL CONT	TRACTOR'S REP.: MIKE RILEY
SPECIALTY CONTRACTOR: NA		SPECIALTY CON	NTRACTOR'S REP. (FOREMAN/SUPT.): NA
Visit	ORS AND OTHER FIRM(s) Represen	TED ON SITE:
FIRM NAME	REPRESENTATIVE	'S TITLE	REPRESENTATIVE'S NAME
WEATHER CONDITIONS: SUNNY, CLI	CAD		Temperature: 82
FIELD ACTIVITY SUBJECT(S): BACKF			TEMPERATURE: 82
CONTRACTOR'S EQUIPMENT: DOZER ON SITE LOCATION OF WORK: SEE D	DENSITY SKETCH	A AAA	
CHANGES FROM PLANS AND SPECIFICATION None See Descriptions of Daily			
IMPORTANT TELEPHONE CALLS: None See Descriptions of Daily	y Activities and Events, Item	Numbers:	
DESCRIPTION OF DAILY ACT	FIVITIES AND EVENT	S:	
Dan Abaray arrived on site at 1	1:00 am and met with F	Kevin of Kemr	on Environmental.
gauge. According to site persplaced in a truck. The materia	sonnel, the material us l was then end dumped pelled sheeps foot com	ed for backfil and spread in pactor. The to	ormed with a Troxler 3430 Nuclear 1 was taken from the stockpile and 8" loose lifts with a dozer. The lift est results are attached along with a evin.
Please note that Dan was not or reviewd by the site engineer in	7		ne fill. These test results should be
Dan Abaray left the site at 3:00	pm.		
those operations, and report those opinior	ns to our client. The presence of the	e Geotechnics repre	ctor(s) identified, form opinions about the adequacy of sentative does not relieve the contractor's obligation to methods and sequences of construction. A preliminary

report is provided solely as evidence that field observation was performed.

Field Representative: Dan Abaray

DATE: September 21, 2007

NUCLEAR DENSITY TEST REPORT



Project Name:	me:		Ormet Landfill	andfill			Project #:	2007-343-02	Date:	9/21/07
Client Name:	ie:		Kemron Environmental	ironmental			Tested by:	DA	Report #:	-
Location;			Hannibal, Ohio	ıl, Ohio			Gauge #:	22446	Model:	3401B
Client Contact:	tact:		Mike Riley	ત્રોey			Density Count	2550	Moisture Count	652
De	Density Standards	sp	Material Description	tion	Proc	Proctor ID	Maximum Dry Density (pcf)	Optimum Moisture	Compaction Requirements	iction ments
	ASTM D698		Stockpile		Performed	Performed by Others	105.3	18.4	85%	%
			Brown lean clay with rock	with rock fragments						
Test#	Proctor ID		Test Location	HJ.	Depth Tested	Wet Density	Dry Density	Moisture (%)	Compaction (%)	Pass/Fail
15	Stockpile		See Sketch	.8	.8	129.7	118.8	9.1	112.9	Pass
16	Stockpile		See Sketch	0	. 8	123.8	111.6	10.9	106.0	Pass
17	Stockpile		See Sketch	80	œ.	128.2	112.8	13.6	107.2	Pass
18	Stockpile		See Sketch		 8	126.2	114.5	10.2	108.8	Pass
19	Stockpile		See Sketch	\$	 8	127.1	115,4	10.2	109.6	Pass
20	Stockpile		See Sketch	 	8	131.5	117.2	12.1	111.3	Pass
21	Stockpile		See Sketch	 	8	129.0	113.9	13.2	108.2	Pass
22	Stockpile		See Sketch	8	8	123.4	110.4	11.7	104.9	Pass
23	Stockpile		See Sketch	8	8	121.3	109.4	10.9	103.9	Pass
24	Stockpile		See Sketch	8	8"	125.1	112.6	11.1	107.0	Pass
·			The state of the s				3			
Field Representative	esentative		Date			Compact	Compaction Methods/ Equipment/Comments	ipment/Comment	S)	
	Dan Abaray		9/21/07	The m	aterial was e	and dumped	The material was end dumped by truck, spread in 8 inch loose lifts with a dozer and then	in 8 inch loose lift:	s with a dozer a	and then
Reviewed By Ran	i By Randy O'Rourke	e)	Date 10/1/2007		3	Jilipacteu wi	compacted with a sen propensed sneepsroot compactor.		pactor.	
			W WHITE THE PROPERTY OF THE PR				***************************************	Weeter Water Company of the Company		

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	9-21-07	Kemron Ormet Plant	
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August 24, 2007

Steven J. Reichenbacher ICF International (781) 676-4079 Tel (339) 206-9095 Cell (781) 676-4005 Fax

E-mail: sreichenbacher@icfi.com

Re: Stone Sieve Analysis

Ormet CMSD Landfill Cap Repair

Dear Mr. Reichenbacher,

Please find attached the sieve analysis that I received from the quarry for the stone aggregate material to be used for the upper diversion berms. Based upon comparison it most closely matches the Specified No. 6 however it is classified in their plant as#57 Gravel (river rock). I have also included their response toward providing the sieve analysis for the riprap which is not normally conducted as a test and is performed on a visual basis which is approved by W V DOT as their plant is in New Martinsville, W. V.

Please do not hesitate to call me at 404.242.5837 to discuss if you require any additional information for these materials.

Sincerely,

Michael Riley Senior Project Manager

Cc: Ralph Grismala, ICF John Mount, Kemron August 16, 2007

08/16/200/ 15:30

Kemron Environmental

Attention: Mike Riley

E-mail: mriley@kemron.com

Dear Mr. Riley,

As a follow up to our phone conversation, I have enclosed our most recent Sieve Analyses on # 57 Limestone, and # 57 Gravel.

In reference to Rip Rap, a visual inspection is utilized in place of sieve analysis. As per West Virginia Division of Highways, Standard Specifications Roads and Bridges, 2000, section 704.2, Stone for Rip Rap, no gradation specifications are required.

If I may be of further assistance, feel free to contact me at (304) 428-3638.

Sincerely,

Gregory L. Smith Quality Assurance Supervisor Martin Marietta Aggregates

cc: Dan Goethel Roger hite 13044B3b334

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ev, 4-03	14	SIEVE ANA	LYSIS OF	AGGREG	GATE			Date	8/15/20	
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ODOT PWL		STKP	<u>AF</u>	PLGRV		8/14/2	007 Pla	ınt	Aggreg	
Test	Material		Quantity		Item Nu	mber	Source		Source (Code
equence	Code #57 GRVL		2718		#57 -	G	NEW MART	INSVILLE	T-012	-B
Sieves: 1st	#57 GRVL	3rd 4	4th	5th	6th	7th	Bth	No. 200		
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) Initial Oven Dry	Mass of Total	Sample	***********	*****					11329.5 (
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Sieve	Retained		Mass Relair	red M _R		Percent Retained	Percent	Percent	Spe	
Size	Sieve	Regule	ar	Combi	nation	(Mr/A)x100	Passing	Passing		
						0.0	99.9	100	10	0
1/1/2"		0.0				2.6	97.3	97	95-1	100
1"		294.				18.2	79.1	79		
3/4"		2067				38.8	40,3	40	25-	60
1/2"		4395 2506				22.1	18.2	18		
3/8"		1870				16,5	1.7	2	0-	
#4		104				0,9	0.8	1	0-	
#8		104.							0-2	2.5
#200		90.	1	*******		,				((3)
(J) Pan	, , q			****			C. F. =	(G)	_ :	(P)
(K) Combination Grad.)				C. F. =		***	
(L) Loss By T-11 (M) Final Total - Reg o	- Consider CT Max		8.4				C. F. =		····	
(M) Final local - Reg o	gms, camp n Te deliveren		Sieve A	nalysis c	of Fine Ag	gregate		A.S.T.M.	I ARTM	O.D.O.T.
Agg, Type: C	Retained	Mas	s Retained M		%	Percent	Reported	A, 5. 1 . W.	- Sp	ec's
Signe	100-				Retained	Percent	Percent	Spec's	ļ	
Size	Sleve	1	Regular		(Mn /(H or A)	Passing	Passing		ļ	
İ		1			x 100					1
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			<u> </u>						_	ļ
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										1
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1.1				···		<u> </u>	Minus No	200 Calcula	tions	
(N) Pan	-4138 1 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7					15 200 Dec	0.0	Fine -No. 2	20 0 Dry	0.0
405 LOSS FW T-11	FRE 6/4-44*PP444444-4-++55.				Coarse -N	lo, <u>200 Diy</u> lo, 200 Wet	0.0	Fine -No.		0.0
(P) Final Total Fine S	ample (Σ Ma)	44444			Coarse -r		0.0		55 (A) or (H)	1132
(C) Final Total -No. 4	(S MR)			ļ <u> </u>	LODAL -140	, LVV	x 100 =		79527	
Commingtion Total	al (M(±Q)			1.1	COMMEN	its.				
(S) Sample Loss of C	Sain (A-M) of	(M-A)		 	SIDE W	ASH = 0.7				
	(H-P) or (F	7•H}	+	1						
CT. Encountries of Ini	(A-R) or (F	(A-5	Tribo 4 (MA)	0.01	_					
on Garagesana of let	Hall OD Mass (6	FEARY YOU (ULIF XIA)	ESPA ESM)							

Ormet Geomembrane Seam Strength Testing

Toe Drain Welder name: Kham I; 85F; Unit G49/G20; 525/500; 11:00: August 8, 2007 (tested on 8/17/07)

Trial Seam Test	Sheer Strength Results (minimum 80 lb/in)	Peel Strength Results (minumum 60 lb/in)
#1	70	69
#2	72	62
#3	72	66
#4	71	68
#5	71	67
Average	71	66

Field Seam Test	Sheer Strength Results (minimum 80 lb/in)	Peel Strength Results (minumum 60 lb/in)
#1	68	60
#2	68	86
#3	66	68
#4	67	67
#5	68	67
Average	67	70

Upper Berm Welder name: Kham I; 88F; Unit G-49; 525/325; 12:30; August 17, 2007

	Sheer Strength Results	Peel Strength Results
Trial Seam Test	(minimum 80 lb/in)	(minumum 60 lb/in)
#1	103	98
#2	102	97
#3	102	102
#4	103	106
#5	102	102
Average	102	101

Welder name: Kham I; 88F; Unit G-49; 525/500; 18:52; August 17, 2007

	Sheer Strength Results	Peel Strength Results
Field Seam Test	(minimum 80 lb/in)	(minumum 60 lb/in)
#1	114	68
#2	116	84
#3	117	72
#4	115	78
#5	110	80
Average	114	76



1359-A Ellsworth Industrial Boulevard ■ Atlanta, GA 30318 ■ Telephone (404) 636-0928 ■ FAX (404) 636-7162 ■ http://www.kemron.com

September 11, 2007

Steven J. Reichenbacher ICF International (781) 676-4079 Tel (339) 206-9095 Cell (781) 676-4005 Fax

E-mail: sreichenbacher@icfi.com

Re: Geomembrane Welding Samples Ormet CMSD Landfill Cap Repair

Dear Mr. Reichenbacher,

Please find attached the lab testing results for the Laboratory Quality Assurance (QA) performed on the placed Geomembrane liner at the Toe of Slope and the Upper Diversion Berms. The samples are as labeled:

- Toe Drain Machine Test Weld Sample
- Toe Drain Actual Weld Sample
- Upper Diversion Berm Machine Test Weld Sample
- Upper Diversion Berm Actual Weld Sample

As Specified each sample required 5 shear strength (80 lb/in – ASTM D 6392) and 5 peel adhesion (60 lb/in – ASTM D 6392) testing to be performed in the laboratory following successful installation of the materials. Due to the size of each sample piece taken, in some cases not all of the 10 pieces/strips were available. In addition the average for the peel adhesion at the Toe of Slope portion averaged 54.3 lbs/in. which did not pass the Specified Testing requirement. Also the required shear strength for the Toe of Slope failed to meet the Shear strength testing criteria. As witnessed during the field testing portion of the work most of the testing of the Toe of Slope materials did not pass due to the fact that the new Geomembrane liner was welded to the existing liner which in some cases showed diminished strength capacities due either to the original material used, the age of the material or in some cases due to potential changes due to the slope failure stresses previously applied.

Please do not hesitate to call me at 404.242.5837 to discuss if you require any additional information for these tests.

Sincerely,

Michael Riley Senior Project Manager

Cc: Ralph Grismala
John Mount

Are these laboratory results, or field tests?

PEEL AND SHEAR TEST RESULTS **DESTRUCTIVE SEAM TESTING**



ASTM D 6392 & 4437 w/NSF 54

CLIENT: KEMRON ENVIRONMENTAL SERVICES CLIENT PROJECT: ORMET CMSD LANDFILL CAP REPAIR

PROJECT NO.: L07163-02 LAB ID NO.; L07163-02-01 MATERIAL: 40 MIL HDPE SEAM TYPE: EXTRUSION

SAMPLE I.D.: TOE DRAIN MACHINE TEST WELD SAMPLE

PEEL ADHESION

REPLICATE	PEAK	EPA BREAK	PEEL
No.	LOAD	CLASSIFICATION	INCURSION
	(lbs/in)	CODE	(%)
OUT	SIDE TRACK (WEL	D "A")	
1	71.2	SE3	<10
2	68,1	\$E3	<10
3	70.2	SE3	<10
4	71.2	SE3	<10
5	70.9	SE3	<10
AVERAGE	70.3		
STD. DEV.	1.31		

BONDED SEAM (SHEAR) STRENGTH

REPLICATE No.	PEAK LOAD	EPA BREAK CLASSIFICATION	
	(lbs/ln)	CODE	CE2 only applies to pool tosts. All the shear
1	71.3	SE3	SE3 only applies to peel tests. All the shear test codes should be SE1. Both codes mean
2	69.5	SE3	a break in the bottom sheet.
3	71.2	SE3	(From J.B. [Jason?], Geotechnics, 18Sep07)
4	70.3	SE3	
5	69,8	SE3	-
AVERAGE	70.4		
STD. DEV.	0.81		

CHECKED BY: <u>UB</u> DATE: <u>8-27-07</u>

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IIGEOSERVERIData DrivelSynthetics/2007 SYNTHETICS/(L07163-02-01 KEMRON xis):1 07163-02-01

8/27/2007

Break codes: see file ASTM D6392 GeomembraneExtrusionSeam BreakCodes.mht

AD Adhesion failure (unacceptable)

AD-BRK Break in first seam after some adhesion failure > 25% incursion

AD1 Failure in adhesion (under bead)

AD2 Failure in adhesion (above bead)

AD-WLD Break through bead

SE1 Break at seam edge, bottom sheet, shear only

SE2 Break at seam edge, top sheet, shear only

SE3 Break at seam edge, bottom sheet, peel only

BRK1 Break in bottom sheet

BRK2 Break in top sheet

HT Break at edge of hot tack, no delamination

SIP Separation in plane

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Page 65 of 80

PEEL AND SHEAR TEST RESULTS **DESTRUCTIVE SEAM TESTING**



ASTM D 6392 & 4437 W/NSF 54

CLIENT: KEMRON ENVIRONMENTAL SERVICES CLIENT PROJECT: ORMET CMSD LANDFILL CAP REPAIR

PROJECT NO.; L07163-02 LAB ID NO.: L07163-02-02 MATERIAL: 40 MIL HDPE SEAM TYPE: EXTRUSION

SAMPLE I.D.: TOE DRAIN ACTUAL WELD DAMPLE

PEEL ADHESION

REPLICATE	PEAK	EPA BREAK	PEEL
No.	LOAD	CLASSIFICATION	INCURSION
	(lbs/in)	CODE	(%)
QUTS	SIDE TRACK (WEL	D "A")	
1	47.5	AD-1	100
2	50.5	SE3	<10
3	65.0	\$E3	<10
4			
5			
AVERAGE	54.3		
STD. DEV.	9.36		

BONDED SEAM (SHEAR) STRENGTH

REPLICATE	PEAK	EPA BREAK
No.	LOAD	CLASSIFICATION
	(lbs/in)	CODE
1	73.1	SE3
2	74,6	SE3
3	73.3	SE3
4		
5		
AVERAGE	73.7	
\$TD, DEV,	0.81	

Sample to short enough for 6 reps only.

CHECKED BY: OB DATE:

I/GEOSERVER/Data Drive/Synthetics/2007 SYNTHETICS/(L07163-02-02 KEMRON.xis): L07163-02-02

8/27/2007

PEEL AND SHEAR TEST RESULTS DESTRUCTIVE SEAM TESTING



ASTM D 6392 & 4437 w/NSF 54

CLIENT: KEMRON ENVIRONMENTAL SERVICES CLIENT PROJECT: ORMET CMSD LANDFILL CAP REPAIR

PROJECT NO.: L07163-02 LAB ID NO.: L07163-02-03 MATERIAL: 40 MIL HDPE SEAM TYPE: EXTRUSION

SAMPLE I.D.: UPPER DIVERSION BERM MACHINE TEST WELD SAMPLE PEEL ADHESION

REPLICATE	PEAK	EPA BREAK	PEEL
No.	LOAD	CLASSIFICATION	INCURSION
	(lbs/in)	CODE	(%)
OUTS	SIDE TRACK (WEL	D "A")	
1	113.9	SE-3	<10
2	109.1	SE-3	<10
3	112.6	SE-3	<10
4	113.6	SE-3	<10
5	116.0	SE-3_	<10
AVERAGE	113.0		
STD. DEV.	2.53		

BONDED SEAM (SHEAR) STRENGTH

REPLICATE	PEAK	EPA BREAK
No.	LOAD	CLASSIFICATION
	(lbs/in)	CODE
1	126.9	SE3
2	129.7	SE3
3	125.8	SE3
4	119.6	SE3
5		
AVERAGE	125.5	
STD. DEV.	4.26	

Sample to short enough for 9 reps only.

CHECKED BY: 15 DATE: 8.27.07

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IIGEOSERVERIData DrivelSynthetics/2007 SYNTHETICS/(L07163-02-03 KEMRON.xis): L07163-02-03

8/27/2007

PEEL AND SHEAR TEST RESULTS DESTRUCTIVE SEAM TESTING



ASTM D 6392 & 4437 w/NSF 54

CLIENT: KEMRON ENVIRONMENTAL SERVICES CLIENT PROJECT: ORMET CMSD LANDFILL CAP REPAIR

PROJECT NO.: L07163-02 LAB ID NO.: L07163-02-04 MATERIAL: 40 MIL HDPE SEAM TYPE: EXTRUSION

SAMPLE I.D.: UPPER DIVERSION BERM **ACTUAL WELD SAMPLE** PEEL ADHESION

REPLICATE	PEAK	EPA BREAK	PEEL
No.	LOAD	CLASSIFICATION	INCURSION
	(lbs/in)	CODE	(%)
OUTS	SIDE TRACK (WEL	D "A")	
1	82.5	SE-3	<10
2	88.3	SE-3	<10
3	71.3	SE-3	<10
4	77.8	SE-3	<10
5	67.0	SE-3	<10
AVERAGE	77.4		
STD, DEV.	8.52		

BONDED SEAM (SHEAR) STRENGTH

REPLICATE	PEAK	EPA BREAK
No.	LOAD	CLASSIFICATION
	(lbs/in)	CODE
1	98.9	SE3
2	97.9	SE3
3	97,9	\$E3
4	101.4	SE3
5		
AVERAGE	99.0	
STD, DEV.	1.65	

Sample to short enough for 9 reps only.

CHECKED BY: 0/5 DATE: 8.27-07

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IIGEOSERVERIData DrivelSynthetics(2007 SYNTHETICS)(L07163-02-04KEMRON xis)5 L07163-02-04

8/27/2007



1359-A Ellsworth Industrial Boulevard ■ Atlanta, GA 30318 ■ Telephone (404) 636-0928 ■ FAX (404) 636-7162 ■ http://www.kemron.com

August 20, 2007

Steven J. Reichenbacher **ICF International** (781) 676-4079 Tel (339) 206-9095 Cell (781) 676-4005 Fax

E-mail: sreichenbacher@icfi.com

Re: Friction Testing Result for the Geonet and Geotextile Materials

Upper Diversion Berm

Ormet CMSD Landfill Cap Repair

Dear Mr. Reichenbacher,

Please find attached the results of the friction testing for the materials as installed in the Toe Drain area. This is the result for the one criterion as listed above. As the result is available for the geotextile and the VSL surface I will forward these on.

Please do not hesitate to call me at 404.242.5837 to discuss if you require any additional information for these materials.

Sincerely,

Michael Riley Senior Project Manager

Cc: Ralph Grismala, ICF John Mount, Kemron

CLIENT: KEMRON

CLIENT PROJECT : ORMET SITE PROJECT NO. : L07163-01

LAB I. D. NO.S: Geonet (L07163-01-02)

Geotextile (L07163-01-01)

INTERFACE: Geonet Vs. Geotextile

STRAIN RATE (in / min): 0.04 DIRECT SHEAR UNIT: G56C-LNL

PLACEMENT CONDITION: Inundated NORMAL LOAD: PNEUMATIC CYLINDERS

NORMAL LOAD	O (psf)	190	NORMAL LOAI	O (psf)	237.5	NORMAL LOAD	(psf)	297
NORMAL LOAD	(psi)	1.3	NORMAL LOAD	O (psi)	1.6	NORMAL LOAD	(psi)	2.1
PEAK SHEAR S'	TRESS (psf)	70	PEAK SHEAR S	TRESS (psf)	91	PEAK SHEAR ST	ΓRESS (psf)	99
RESIDUAL SHE	AR (psf)	68	RESIDUAL SHE	RESIDUAL SHEAR (psf) 76		RESIDUAL SHEAR (psf)		85
	HORIZONTAL			HORIZONTAL			HORIZONTAL	
DISPLACE.	SHEAR FORCE	STRESS	DISPLACE.	SHEAR FORCE	STRESS	DISPLACE.	SHEAR FORCE	STRESS
(in.)	(lbs)	(psf)	(in.)	(lbs)	(psf)	(in.)	(lbs)	(psf)
0.000	0	0	0.000	0	0	0.000	0	0
0.005	6	6	0.005	48	48	0.005	6	6
0.025	26	26	0.025	70	70	0.025	83	83
0.045	56	56	0.045	75	75	0.045	92	92
0.060	61	61	0.060	75	75	0.060	93	93
0.083	60	60	0.083	73	73	0.083	89	89
0.100	59	59	0.100	72	72	0.100	87	87
0.120	58	58	0.120	71	71	0.120	87	87
0.143	57	57	0.143	73	73	0.143	86	86
0.165	58	58	0.165	73	73	0.165	86	86
0.200	59	59	0.200	71	71	0.200	86	86
0.225	59	59	0.225	71	71	0.225	87	87
0.270	59	59	0.270	72	72	0.270	90	90
0.320	61	61	0.320	78	78	0.320	93	93
0.350	61	61	0.350	82	82	0.350	94	94
0.400	62	62	0.400	86	86	0.400	96	96
0.450	63	63	0.450	89	89	0.450	97	97
0.500	63	63	0.500	91	91	0.500	97	97
0.600	64	64	0.600	91	91	0.600	98	98
0.650	64	64	0.650	90	90	0.650	98	98
0.695	65	65	0.695	89	89	0.695	98	98
0.750	64	64	0.750	88	88	0.750	99	99
0.800	65	65	0.800	88	88	0.800	98	98
0.850	65	65	0.850	88	88	0.850	98	98
0.900	65	65	0.900	90	90	0.900	95	95
0.995	66	66	0.995	91	91	0.995	95	95
1.200	67	67	1.200	90	90	1.200	93	93
1.400	68	68	1.400	90	90	1.400	91	91
1.655	69	69	1.655	84	84	1.655	89	89
1.800	69	69	1.800	83	83	1.800	89	89
2.000	70	70	2.000	82	82	2.000	89	89
2.245	68	68	2.245	77	77	2.245	88	88
2.475	68	68	2.475	77	77	2.475	86	86
2.600	69	69	2.600	76	76	2.600	85	85
2.800	68	68	2.800	76	76	2.800	85	85

PAGE 3 OF 3 APPROVED BY : ____ DATE : ____

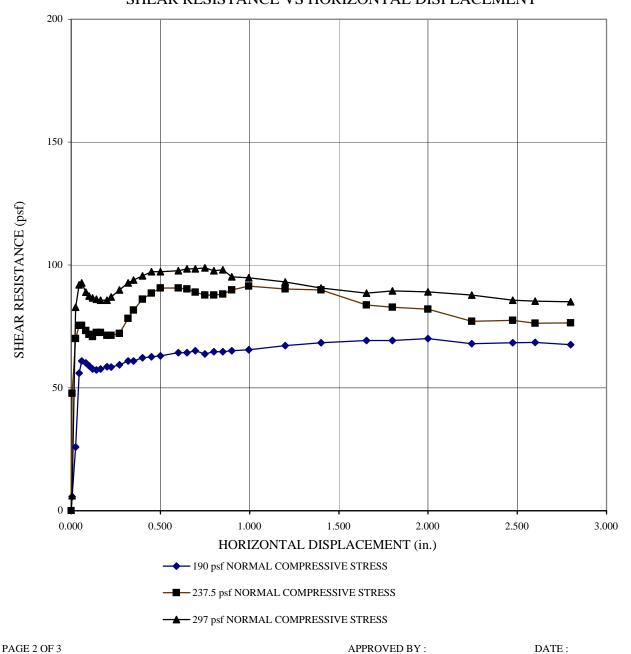
8/17/2007

CLIENT: KEMRON CLIENT PROJECT: ORMET SITE PROJECT NO.: L07163-01

> LAB I. D. NO.: Geonet (L07163-01-02) Geotextile (L07163-01-01)

INTERFACE: Geonet Vs. Geotextile

SHEAR RESISTANCE VS HORIZONTAL DISPLACEMENT



8/17/2007

CLIENT: KEMRON **CLIENT PROJECT: ORMET SITE** PROJECT NO.: L07163-01

LAB I. D. NO.: Geonet (L07163-01-02)

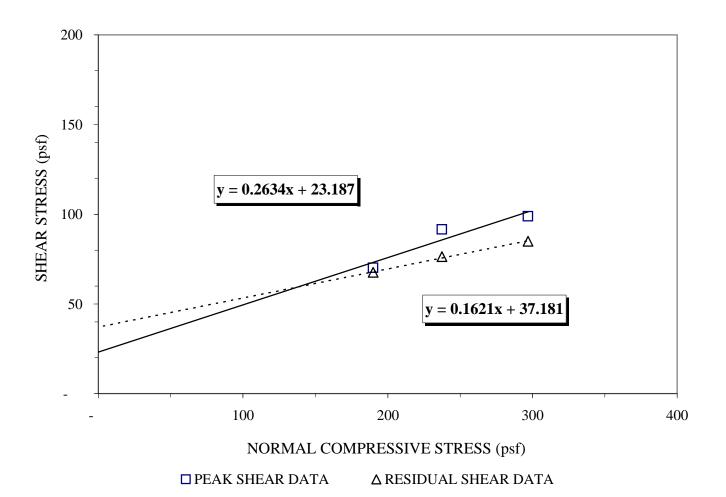
Geotextile (L07163-01-01)

INTERFACE: Geonet Vs. Geotextile

PEAK SHEAR		RESIDUA	AL SHEAK	
FRICTION ANGLE (deg):	$\Phi =$	14.8	$\Phi =$	9.2
COEFFICIENT OF FRICTION:	=	0.263	=	0.162
ADHESION [Calculated] (psf):	a =	23	a =	37

NOTES:

- 1.)A component of the shear strength values reported may be an anomaly of the laboratory procedure.
- 2.) The interface was placed under load and inundated with water for 30 minutes prior to shearing.
- 3.) The peak friction angle was calculated using linear regression on the three data points.
- 4.) The residual friction angle was calculated using linear regression on the end of test values.



PAGE 1 OF 3 APPROVED BY: L07163-01

\\geoserver\Data Drive\Mike D\Interface Data\[L07163-01 - Interface 1 - Geonet vs geotextile.xls]3 Points

8/17/2007



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August 30 2007

Steven J. Reichenbacher ICF International (781) 676-4079 Tel (339) 206-9095 Cell (781) 676-4005 Fax

E-mail: sreichenbacher@icfi.com

Re: Friction Angle Laboratory Testing Results

Toe of Slope Materials

Ormet CMSD Landfill Cap Repair

Dear Mr. Reichenbacher,

Please find attached the Friction Angle results for the materials provided in the toe of slope construction including the Tencate Geotextile (Mirafi S800) and the SKAPS Geonet (Transnet 200). The attached laboratory testing was performed by Geotechnics for the interfaces between the Geonet and the Geotextile and also between the Geotextile and the Vegetative Soil Layer (VSL).

Please do not hesitate to call me at 404.242.5837 to discuss if you require any additional information for these materials.

Sincerely,

Michael Riley Senior Project Manager

Cc: Ralph Grismala, ICF John Mount, Kemron

CLIENT: KEMRON

CLIENT PROJECT : ORMET SITE PROJECT NO. : L07163-01

LAB I. D. NO.S: Soil (L07163-01-03)

Geotextile (L07163-01-01)

INTERFACE: Soil @ 95.5 pcf & 14.8% W.C. Vs. Geotextile

STRAIN RATE (in / min): 0.005 DIRECT SHEAR UNIT: G56C-LNL

PLACEMENT CONDITION: Inundated NORMAL LOAD: PNEUMATIC CYLINDERS

NORMAL LOAD			NORMAL LOAI	O (psf)	237.5	NORMAL LOAD	(psf)	297
NORMAL LOAD	(psi)	1.3	NORMAL LOAI	O (psi)	1.6	NORMAL LOAD	(psi)	2.1
PEAK SHEAR ST	TRESS (psf)	133	PEAK SHEAR S	PEAK SHEAR STRESS (psf)		PEAK SHEAR ST	ΓRESS (psf)	218
RESIDUAL SHE	AR (psf)	132	RESIDUAL SHE	RESIDUAL SHEAR (psf) 160		RESIDUAL SHEAR (psf)		217
	HORIZONTAL			HORIZONTAL		1	HORIZONTAL	
DISPLACE.	SHEAR FORCE	STRESS	DISPLACE.	SHEAR FORCE	STRESS	DISPLACE.	SHEAR FORCE	STRESS
(in.)	(lbs)	(psf)	(in.)	(lbs)	(psf)	(in.)	(lbs)	(psf)
0.000	0	0	0.000	0	0	0.000	0	0
0.005	19	19	0.005	44	44	0.005	37	37
0.025	36	36	0.025	49	49	0.025	38	38
0.045	40	40	0.045	66	66	0.045	44	44
0.060	43	43	0.060	74	74	0.060	58	58
0.083	50	50	0.083	85	85	0.083	82	82
0.100	59	59	0.100	91	91	0.100	95	95
0.120	69	69	0.120	98	98	0.120	109	109
0.143	75	75	0.143	105	105	0.143	120	120
0.165	80	80	0.165	111	111	0.165	131	131
0.200	88	88	0.200	120	120	0.200	145	145
0.225	92	92	0.225	124	124	0.225	152	152
0.270	98	98	0.270	130	130	0.270	163	163
0.320	104	104	0.320	137	137	0.320	173	173
0.350	108	108	0.350	140	140	0.350	179	179
0.400	112	112	0.400	145	145	0.400	187	187
0.450	116	116	0.450	151	151	0.450	195	195
0.500	119	119	0.500	156	156	0.500	200	200
0.600	124	124	0.600	160	160	0.600	214	214
0.650	127	127	0.650	160	160	0.650	216	216
0.695	130	130	0.695	160	160	0.695	217	217
0.750	132	132	0.750	160	160	0.750	216	216
0.800	133	133	0.800	160	160	0.800	217	217
0.850	133	133	0.850	160	160	0.850	216	216
0.900	133	133	0.900	160	160	0.900	217	217
0.995	133	133	0.995	160	160	0.995	217	217
1.200	133	133	1.200	160	160	1.200	217	217
1.400	133	133	1.400	161	161	1.400	217	217
1.655	133	133	1.655	160	160	1.655	217	217
1.800	133	133	1.800	160	160	1.800	218	218
2.000	133	133	2.000	160	160	2.000	217	217
2.245	132	132	2.245	160	160	2.245	218	218
2.475	132	132	2.475	160	160	2.475	218	218
2.600	132	132	2.600	160	160	2.600	217	217
2.800	132	132	2.800	160	160	2.800	217	217
	1					1	<u> </u>	

 PAGE 3 OF 3
 APPROVED BY :
 DATE :

 \\geoserver\Data Drive\Mike D\Interface Data\\[L07164-01 - Interface 1.xls\]3 Points
 L07163-01
 8/29/2007

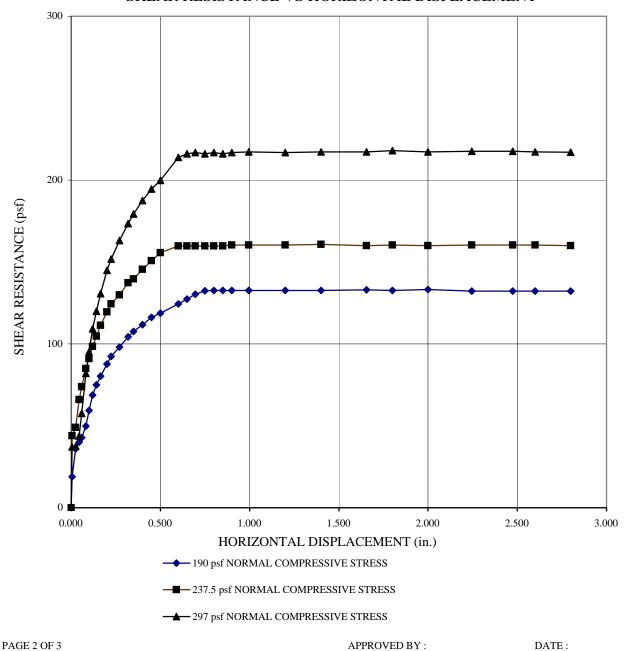
CLIENT : KEMRON CLIENT PROJECT : ORMET SITE PROJECT NO. : L07163-01

LAB I. D. NO.: Soil (L07163-01-03)

Geotextile (L07163-01-01)

INTERFACE : Soil @ 95.5 pcf & 14.8% W.C. Vs. Geotextile

SHEAR RESISTANCE VS HORIZONTAL DISPLACEMENT



L07163-01

8/29/2007

CLIENT : KEMRON CLIENT PROJECT : ORMET SITE PROJECT NO. : L07163-01

LAB I. D. NO.: Soil (L07163-01-03)

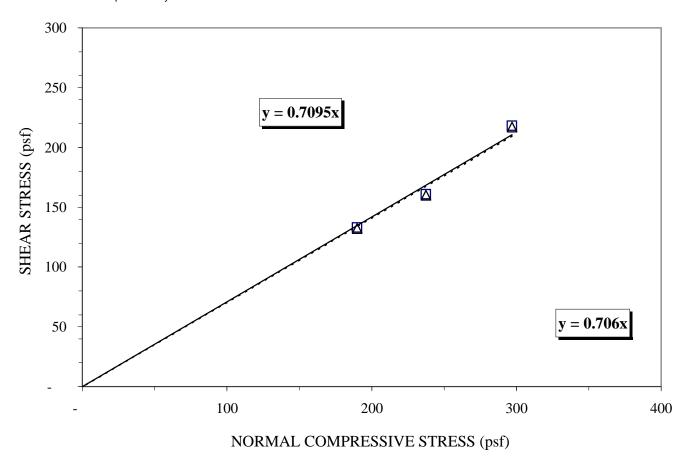
Geotextile (L07163-01-01)

INTERFACE: Soil @ 95.5 pcf & 14.8% W.C. Vs. Geotextile

	PEAK SH	HEAR	RESIDUAL	SHEAR
FRICTION ANGLE (deg):	$\Phi =$	35.4	$\Phi = 3$	5.2
COEFFICIENT OF FRICTION:	=	0.710	= 0.	706
ADHESION [Calculated] (psf):	a =	0	$\mathbf{a} = 0$	

NOTES:

- 1.)A component of the shear strength values reported may be an anomaly of the laboratory procedure.
- 2.) The interface was placed under load and inundated with water for 24 hours prior to shearing.
- 3.) The peak friction angle was calculated using linear regression on the three data points.
- 4.) The residual friction angle was calculated using linear regression on the end of test values.
- 5.)Soil placement criteria based upon 85% soil dry density & ± 3% Opt. W.C. from Borrow Soil proctor provided by client.



 PAGE 1 OF 3
 APPROVED BY :
 DATE :

 \\geoserver\Data Drive\Mike D\Interface Data\[L07164-01 - Interface 1.xls]3 Points
 L07163-01
 8/29/2007

Δ RESIDUAL SHEAR DATA

□ PEAK SHEAR DATA



1359-A Ellsworth Industrial Boulevard ■ Atlanta, GA 30318 ■ Telephone (404) 636-0928 ■ FAX (404) 636-7162 ■ http://www.kemron.com

August 22, 2007

Steven J. Reichenbacher ICF International (781) 676-4079 Tel (339) 206-9095 Cell (781) 676-4005 Fax

E-mail: sreichenbacher@icfi.com

Re: Density Testing Results

Failed Area Backfill Completed 8-15-07 Ormet CMSD Landfill Cap Repair

Dear Mr. Reichenbacher,

Please find attached the Friction Angle result for the AEG provided material that was used for the upper diversion berm area. As you remember we are not performing the testing for the surface between the Geonet/Geotextile Fabric as they are a composite. However the friction testing was performed for the surface between the Geotextile and VSL.

Please do not hesitate to call me at 404.242.5837 to discuss if you require any additional information for these materials.

Sincerely,

Michael Riley Senior Project Manager

Cc: Ralph Grismala, ICF John Mount, Kemron

Interface Friction Test Report

Client: American Environmental, Group Project:

Ormet-Hannibal, OH Landfill

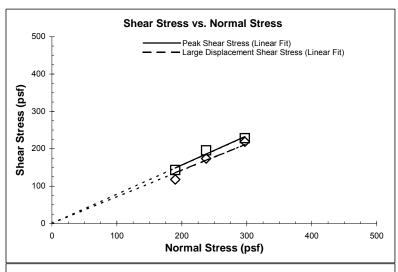
Test Date: 08/17/07-08/21/07

TRI Log#: E2279-47-07 Test Method: ASTM D 5321

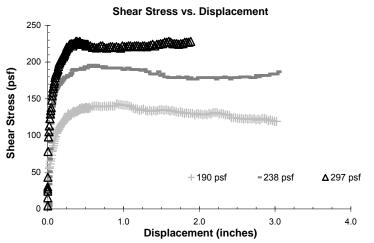
John M. Allen, E.I.T., 08/21/2007

Quality Review/Date

Tested Interface: VSL Soil vs. Agru Single-sided Geocomposite (515522-07)



Test Results			
	Peak	Large Displacement (@ 3.0 in.)	
Friction Angle (degrees):	38.1	35.5	
Y-intercept or Adhesion (psf):	0	0	



Test Conditions Upper Box & VSL Soil remolded to 122.4 pcf at 24.6% moisture content based on remolding density of direct shear testing Lower Box Agru single-sided geocomposite (geotextile side) Box Dimensions: 12"x12"x4"

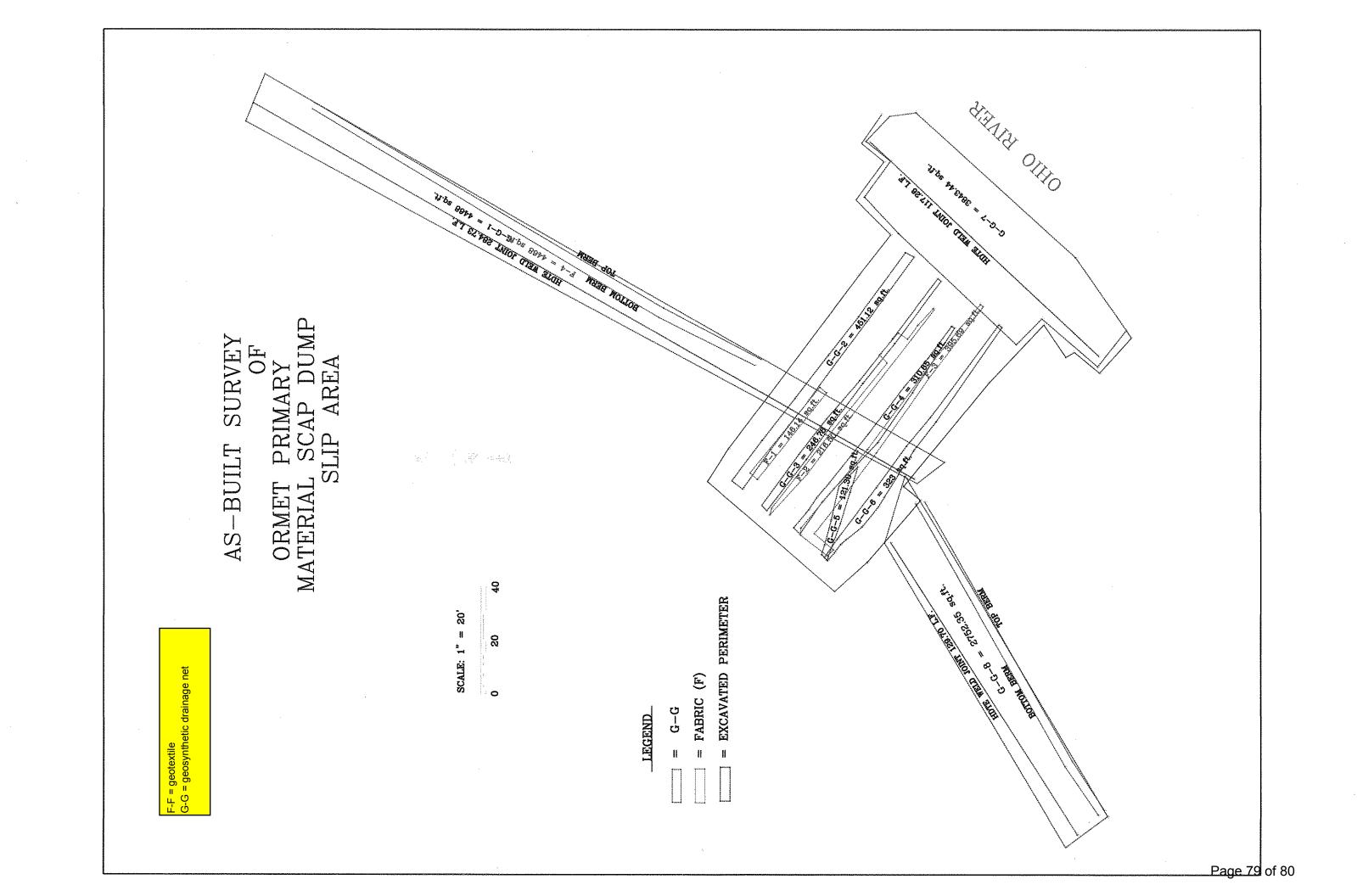
Interface Interface soaked and loading applied for Conditioning: a minimum of 24 hours prior to shear.

Test Condition: Wet

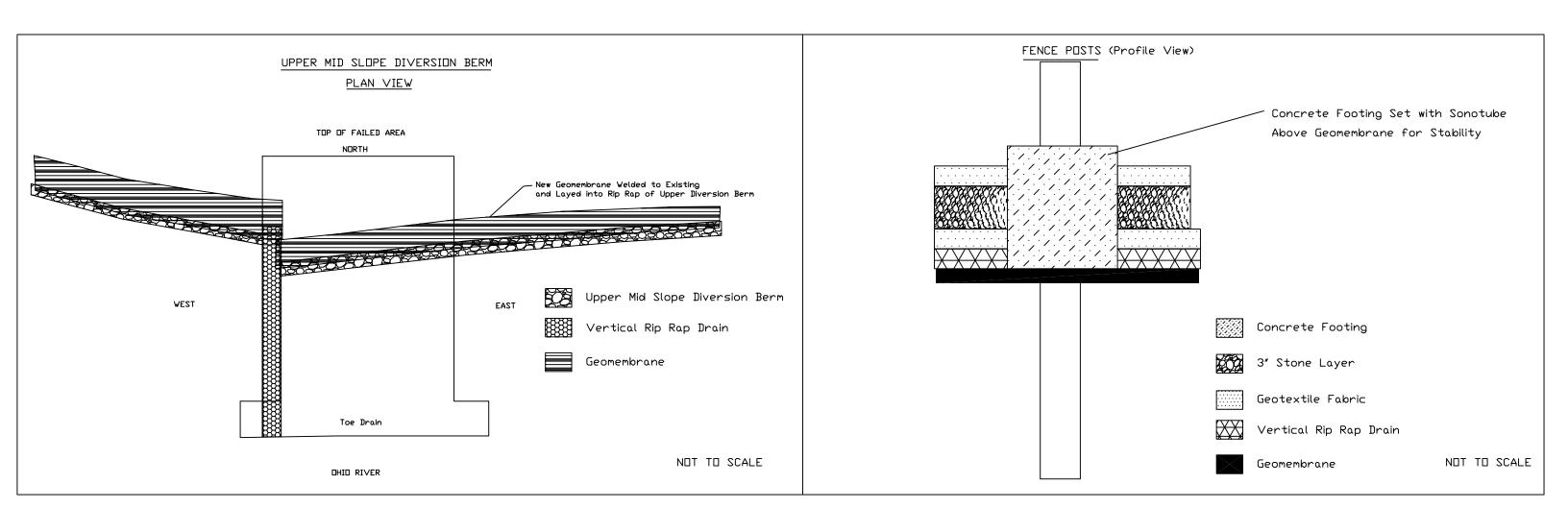
Shearing Rate: 0.004 inches/minute

Test Data				
Specimen No.	1	2	3	
Bearing Slide Resistance (lbs)	10	10	11	
Normal Stress (psf)	190	238	297	
Corrected Peak Shear Stress (psf)	143	196	228	
Corrected Large Displacement Shear Stress (psf)	118	174	219	
Peak Secant Angle (degrees)	37.0	39.5	37.5	
Large Displacement Secant Angle (degrees)	31.8	36.2	36.4	

The testing herein is based upon accepted industry practice as well as the test method listed. Test results reported herein do not apply to samples other than those tested. TRI neither accepts responsibility for nor makes claim as to the final use and purpose of the material. TRI observes and maintains client confidentiality. TRI limits reproduction of this report, except in full, without prior approval of TRI.



ORMET CMSD





Memorandum

Date: 6 August 2007

To: Mr. John Reggi

Ormet Primary Aluminum Corporation

From: Ralph Grismala

ICF International rgrismala@icfi.com

Subject: Kemron Submittals – Geosynthetic Manufacturers' Product Specifications

Ormet CMSD Landfill Cap Repair

Re: 026156

This memorandum discusses the Kemron's submittal of the manufacturers' product specifications for the following geosynthetic materials:

- TenCate Geotextile Mirafi S800
- SKAPS Geonet Transnet 200
- GSE HD Textured Geomembrane, HDT040G000

TenCate Geotextile Mirafi S800

The product specification sheet indicates that the product selected by Kemron, TenCate Mirafi S800, meets the material requirements for the geotextile detailed in Section 31 05 19, Part 2.1 of the project specifications, except as noted below:

- Trapezoidal Tear Strength equals 85 lb, vs. 95 lb minimum required
- Permittivity equals 1.36/sec, vs. 1.80/sec required

Although both of these parameters are below the values of the manufacturer's specifications for the existing geotextile, they are above the values specified in the original design specifications. We have checked the permittivity value of the Mirafi S800 against the drainage capacity of the VSL and have determined that it is adequate for the conditions at the CMSD landfill cap. The trapezoidal tear strength is an index value and does not have a direct correlation with a likely failure mode. The trapezoidal tear strength is an indication of the survivability of the geotextile during installation. We will accept the use of the Mirafi S800 geotextile, but Kemron will need to use extra care to prevent damage to the geotextile during installation. Any damaged geotextile will be removed and replaced at Kemron's expense.

Under the above conditions, we accept Kemron's use of Mirafi S800.

SKAPS Geonet Transnet 200

GeosyntheticAcceptance.doc.6Aug07

Date: 6 August 2007To: Mr. John ReggiFrom: Ralph Grismala

Subject: Kemron Submittals – Geosynthetic Manufacturers' Product Specifications

Page: 2

The product specification sheet indicates that the product selected by Kemron, SKAPS Geonet Transnet 200, meets the material requirements for the geosynthetic drainage layer detailed in Section 31 05 19, Part 2.2 of the project specifications.

We are unable to identify a current product called Transnet 200 either on the SKAPS website (http://www.skaps.com/geonet/geonet.htm) or on the Engineered Synthetic Products website (http://www.espgeosynthetics.com/skaps/). The manufacturer's product specifications for Transnet 220 are identical to the product specifications submitted by Kemron for Transnet 200.

We accept the use of either Transnet 200 or Transnet 200.

GSE HD Textured Geomembrane, HDT040G000

The product specification sheet indicates that the product selected by Kemron, GSE HD Textured Geomembrane, HDT040G000, meets the material requirements for the geomembrane detailed in Section 31 05 19, Part 2.3 of the project specifications, except as noted below:

• Tear Resistance equals 28 lb, vs. 33 lb minimum required

The manufacturer's product specification for tear resistance is lower than the original CMSD landfill cap specification. Nevertheless, since the current repair project will only require geomembrane installation in areas generally flatter than the 4:1 (horizontal:vertical) slope, the installation stresses on the geomembrane should be lower than during the original cap construction. We will accept the use of the GSE HDT040G000 geomembrane, but Kemron will need to use extra care to prevent damage to the geomembrane during installation. Any damaged geomembrane will be removed and replaced at Kemron's expense.

Under the above conditions, we accept Kemron's use of GSE HDT040G000.



Memorandum

Date: 21 August 2007

To: Mr. John Reggi

Ormet Primary Aluminum Corporation

From: Ralph Grismala

ICF International rgrismala@icfi.com

Subject: Kemron Submittals – Geosynthetic Manufacturer's Product Specifications

Ormet CMSD Landfill Cap Repair

Re: 026156

This memorandum discusses the manufacturers' product specifications and Kemron's submittal of the manufacturer's individual roll test data for the following geosynthetic materials:

- Agru America Geocomposite 6-200
- Agru America Micro Spike HDPE Textured Geomembrane, 40 mil

Agru America Geocomposite 6-200

NOTE: The geotextile in this geocomposite differs from the geotextile product previously proposed by Kemron and accepted on 6 August 2007 (TenCate Mirafi S800).

NOTE: The geonet in this geocomposite differs from the geonet product previously proposed by Kemron and accepted on 6 August 2007 (SKAPS Geonet Transnet 200).

Kemron submitted manufacturer's roll test data for geocomposite rolls number 515314-07, 515522-07, 515523-07, and 515524-07. The data presented for the geotextile component of the geocomposite (Daltex 1060E) are not from tests performed on the specific geotextile used in the geocomposite rolls sent to Ormet, but from tests on other rolls within three sets of geotextile rolls with sequential roll numbers apparently associated with a project referred to as Springfield Landfill. The roll numbers of the geotextile used in the geocomposite rolls sent to Ormet are within one of the sequential sets of geotextile roll numbers. The data presented for the geonet and for the geocomposite are not from tests performed on the specific material in the geocomposite rolls sent to Ormet, but from Agru America's database of tests performed on similar materials¹. The reported values for roll number 515314-07 differ from the reported values for the other three rolls.

GeosyntheticAcceptance 070821.doc.21Aug07

¹ From telephone conversation with Mr. Palmer, Quality Control Manager, Agru America, 20Aug07.

Date: 21 August 2007
To: Mr. John Reggi
From: Ralph Grismala

Subject: Kemron Submittals – Geosynthetic Manufacturer's Product Specifications

Page: 2

The manufacturer's test data submitted by Kemron indicate that the product selected by Kemron, Agru America Geocomposite 6-200, meets the material requirements for the geocomposite detailed in Section 31 05 19, Part 2.2 of the project specifications, except as noted below:

Geotextile¹:

- Mass per Unit Area equals 6.4 oz., vs. 8 oz. minimum required
- Grab Strength equals 194 lbs, vs. 230 lbs. minimum required
- Puncture Strength equals 103 lbs. vs. 120 lbs. minimum required
- Trapezoidal Tear Strength equals 80 lb, vs. 95 lb minimum required
- Apparent Opening Size (U.S. Sieve) equals 70, vs. 100 maximum allowed
- Permittivity equals 1.65/sec, vs. 1.80/sec required

Although the Grab Strength, Puncture Strength, and Trapezoidal Tear Strength are below the values of the manufacturer's specifications for the existing geotextile in the CMSD landfill cap, they are above the values specified in the original design specifications. The current repair will only require geocomposite installation along the upper midslope diversion channel, i.e. in an area where the slope is generally flatter than the 4:1 (horizontal:vertical), and therefore the stresses on the Agru America Geocomposite 6-200 will be less than the typical stresses on the existing geosynthetics. The trapezoidal tear strength is an index value and does not have a direct correlation with a likely failure mode. The trapezoidal tear strength is an indication of the survivability of the geotextile component of the geocomposite during installation. Kemron will need to use extra care to prevent damage to the geotextile during installation. Any damaged geocomposite will be removed and replaced at Kemron's expense.

We do not have sufficient test data to conclusively determine the potential effect of the failure to meet the Apparent Opening Size (AOS) criterion. AOS, as defined by ASTM D4751 indicates the smallest size particle such that, under the test conditions, the geotextile will permit less than 5% of that size particle to pass through the geotextile. In the absence of specific test data and with more than 75% of the Vegetative Support Layer (VSL) soil finer than the No. 100 sieve, we can not relax the AOS criterion without mitigation. Any Agru America Geocomposite 6-200 installed by Kemron will need to be overlain by an additional layer of nonwoven geotextile meeting the project specifications.

We have checked the permittivity value of the Daltex 1060E geotextile against the drainage capacity of the VSL and have determined that it is adequate for the conditions at the CMSD landfill cap. The addition of a second layer of nonwoven geotextile to meet the project specification for AOS will result in a lower permittivity, but one which will remain higher than the drainage capacity of the VSL.

¹ Unless otherwise noted, values shown are Minimum Average Roll Values (MARV) for 5 rolls within a set of 32 sequential roll numbers (1010086529 to 1010086560). The geotextile in the geocomposite sent to Ormet came from Daltex 1060E roll numbers 1010086537, 1010086545, and 1010086548. MARV equals the average roll value minus two standard deviations. Roll data from Springhill Landfill test data, 30 Apr 2007.

Date: 21 August 2007
To: Mr. John Reggi
From: Ralph Grismala

Subject: Kemron Submittals – Geosynthetic Manufacturer's Product Specifications

Page: 3

Under the above conditions, we accept Kemron's use of Agru America Geocomposite 6-200 along the upper midslope diversion channel when overlain by an additional geotextile. It is not approved for use elsewhere.

Agru America Micro Spike HDPE Textured Geomembrane, 40 mil

NOTE: This product differs from the textured geomembrane product previously proposed by Kemron and accepted on 6 August 2007 (GSE HD Textured Geomembrane, HDT040G000).

The manufacturer's product specification sheet indicates that the product selected by Kemron, Agru America Micro Spike HDPE Textured Geomembrane, 40 mil, meets the material requirements for the geomembrane detailed in Section 31 05 19, Part 2.3 of the project specifications, except as noted below:

• Tear Resistance equals 30 lb, vs. 33 lb minimum required

The manufacturer's product specification for tear resistance is lower than the original CMSD landfill cap specification. Nevertheless, since the current repair project will only require geomembrane installation in areas generally flatter than the 4:1 (horizontal:vertical) slope, the installation stresses on the geomembrane should be lower than during the original cap construction. Moreover, the manufacturer's individual roll test data for roll number 319714-07 indicates a tear resistance of 36.6 lbs which meets the criterion. If Kemron elects to use any rolls of Micro Spike HDPE geomembrane with tear resistance below 33 lbs, then Kemron will need to use extra care to prevent damage to the geomembrane during installation. Any damaged geomembrane will be removed and replaced at Kemron's expense.

Under the above conditions, we accept Kemron's use of Micro Spike HDPE, 40 mil. We accept the use of roll number 319714-07 without conditions.



Memorandum

Date: 24 August 2007

To: Mr. John Reggi, Ormet Primary Aluminum Corporation cc: Mr. Michael Riley, Kemron Environmental Services

From: Ralph Grismala

ICF International rgrismala@icfi.com

Subject: Kemron Submittal – Aggregate

Ormet CMSD Landfill Cap Repair

Re: 026156

This memorandum discusses Kemron's submittal "Stone Sieve Analysis" dated 24 August 2007 for the stone aggregate material related to the upper diversion berms. Section 31 00 00 of the project specifications calls for the following two types of aggregate for the upper diversion berms:

- Rip-Rap for Midslope Diversion Berms (Part 2.2.2)
- Gravel for Slope Drains (Part 2.3)

The submittal did not include information on the following aggregate materials:

- Rip-Rap for Riverbank Protection (Part 2.2.1)
- Slope Toe Drainage Blanket (Toe Drain Revision, Design Detail)

Rip-Rap for Midslope Diversion Berms

The rip-rap for the midslope diversion berms must conform to Ohio DOT Type D material which has at least 85 percent larger than 3-inch but less than 12-inch and at least 50 percent larger than a 6-inch (150 mm) square opening. Kemron intends to inspect the rip-rap particle size distribution visually, as suggested by Kemron's supplier, Martin Marietta Aggregates.

We accept Kemron's proposal to rely on visual inspection of the rip-rap particle size distribution, with the stipulation that the material is subject to the inspection and approval of Ormet's Technical Representative.

Gravel for Slope Drains

Kemron has requested that the use of AASHTO M43 Size 57 aggregate be allowed for the gravel blanket in the midslope diversion channel, instead of the AASHTO M43 Size 6 aggregate

AggregateAcceptance_070824.doc.24Aug07

Date: 24 August 2007
To: Mr. John Reggi
From: Ralph Grismala

Subject: Kemron Submittal – Aggregate

Page: 2

specified. Martin Marietta Aggregates has supplied sieve analysis results of the proposed aggregate.

We accept the substitution of AASHTO M43 Size 57 aggregate and approve the use of the proposed aggregate.



Memorandum

Date: 18 September 2007

To: Mr. John Reggi, Ormet Primary Aluminum Corporation **cc:** Mr. Michael Riley, Kemron Environmental Services

From: Ralph Grismala

ICF International rgrismala@icfi.com

Subject: Geomembrane Seam Acceptance

Ormet CMSD Landfill Cap Repair

Re: 026156

This memorandum discusses seam field and laboratory testing results for the Quality Assurance (QA) performed on the geomembrane liner at the Toe Drain and the Upper Diversion Berms. The analysis considers data on the following tested seams:

Seam Location and Type	Upper Geomembrane in Seam	Lower Geomembrane in Seam
Toe Drain Trial Seam	New GSE HD Textured	New GSE HD Textured
(Machine Test Weld Sample)	HDT040G000	HDT040G000
Toe Drain Field Seam	New GSE HD Textured	Existing HDPE Textured 40 mil
(Actual Weld Sample)	HDT040G000	
Upper Diversion Berm Trial Seam	New Agru America Micro Spike	New Agru America Micro Spike
(Machine Test Weld Sample)	HDPE Textured 40 mil	HDPE Textured 40 mil
Upper Diversion Berm Field	New Agru America Micro Spike	Existing HDPE Textured 40 mil
Seam (Actual Weld Sample)	HDPE Textured 40 mil	-

Note that the geomembrane added at the toe drain, GSE HD Textured HDT040G000, differs from the geomembrane added at the upper diversion berm, Agru America Micro Spike HDPE Textured 40 mil.

The seam shear strength requirements from the specifications (Section 31 05 19, Part 2.3.2) appear in Table 1.

Table 1: Seam Strength Requirements

Property	Test Value	Test Method
Seam Shear Strength (min)	80 lb/in	ASTM D 6392
Seam Peel Strength (min)	60 lb/in	ASTM D 6392

Note: Seam tests for peel and shear must fail in the Film Tear Bond mode. This is a failure in the ductile mode of one of the bonded sheets by tearing or breaking prior to complete separation of the bonded area.

GeomembraneSeamAcceptance_070918.doc.18Sep07

Date: 18 September 2007To: Mr. John ReggiFrom: Ralph Grismala

Subject: Geomembrane Seam Acceptance

Page: 2

Trial Seams

The repair specifications (Section 31 05 19, Part 3.3.4.1) required that 5 specimens be field tested for shear strength and that 5 specimens be field tested for peel strength, with 4 out of 5 specimens meeting the seam strength requirements in Table 1. Laboratory tests of the trial seams were not required, but were performed. The results of the tests on the trial seams are summarized below:

Sample	Property	No. of Specimens	% Meeting Strength	% Meeting Failure Mode	Comments
		•	Requirement	Requirement	
Toe Drain Trial	Shear	5	0%	100%	Accepted
Seam – Field Test	Strength				71 lb average
Toe Drain Trial	Peel	5	100%	100%	OK
Seam – Field Test	Strength				66 lb average
Upper Diversion	Shear	5	100%	100%	OK
Berm Trial Seam	Strength				102 lb average
Field Test					
Upper Diversion	Peel	5	100%	100%	OK
Berm Trial Seam	Strength				101 lb average
– Field Test					
Toe Drain Trial	Shear	5	0%	100%	Accepted
Seam – Lab Test	Strength				70.4 lb average
Toe Drain Trial	Peel	5	100%	100%	OK
Seam – Lab Test	Strength				70.3 lb average
Upper Diversion	Shear	4	100%	100%	OK
Berm Trial Seam	Strength				125.5 lb average
– Lab Test					
Upper Diversion	Peel	5	100%	100%	OK
Berm Trial Seam	Strength				113.0 lb average
–Lab Test					

All of the trial seam tests met the specification criteria except for the Toe Drain Trial Seam shear strength tests. Both the field and lab results for the Toe Drain Trial Seam shear tests showed shear strength equal to about 88% of the specification requirement. The strength results for the GSE HD Textured HDT040G000 are consistent with the manufacturer's product specification which reports a tensile strength at break equal to 60 lb/in. Both the field tests and the lab tests confirmed that failure occurs in the sheet and not in the weld. Since the toe drain seam is at the toe of the slope in a location subject to lower tensile stresses in the geomembrane than most of the slope, we approved the trial seam tests.

Date: 18 September 2007To: Mr. John ReggiFrom: Ralph Grismala

Subject: Geomembrane Seam Acceptance

Page: 3

Field Seams

The repair specifications (Section 31 05 19, Part 3.3.6.3) required that 5 specimens be field tested for shear strength and 5 specimens be field tested for peel strength, with 4 out of 5 specimens meeting the seam strength requirements in Table 1. The specifications also required that 5 specimens be lab tested for shear strength and 5 specimens be lab tested for peel strength, with 4 out of 5 specimens meeting the seam strength requirements in Table 1. The results of the tests on the field seams are summarized below:

Sample	Property	No. of Specimens	% Meeting Strength Requirement	% Meeting Failure Mode Requirement	Comments
Toe Drain Field	Shear	5	0%	100%	Accepted
Seam – Field Test	Strength				67 lb average
Toe Drain Field	Peel	5	100%	100%	OK
Seam – Field Test	Strength				70 lb average
Upper Diversion	Shear	5	100%	100%	OK
Berm Field Seam	Strength				114 lb average
- Field Test					
Upper Diversion	Peel	5	100%	100%	OK
Berm Field Seam	Strength				76 lb average
– Field Test					
Toe Drain Field	Shear	3	0%	100%	Accepted
Seam – Lab Test	Strength				73.7 lb average
Toe Drain Field	Peel	3	33%	67%	Accepted
Seam – Lab Test	Strength				54.3 lb average
Upper Diversion	Shear	4	100%	100%	OK
Berm Field Seam	Strength				99.0 lb average
– Lab Test					
Upper Diversion	Peel	5	100%	100%	OK
Berm Field Seam	Strength				77.4 lb average
– Lab Test					

Neither the field tests nor the laboratory tests for the Toe Drain Field Seam met the specifications for shear strength. The field and laboratory results for the Toe Drain Trial Seam shear tests showed shear strength between 82% and 93% of the specification requirement. Since the toe drain seam is at the toe of the slope in a location subject to lower tensile stresses in the geomembrane than most of the slope, we approved the field seam shear tests.

The field tests for the Toe Drain Field Seam met the specification for peel strength, but the laboratory tests did not. The laboratory tests ranged from 79% to 108% of the specification requirement. One of the laboratory tests failed by delamination of the weld from the older geomembrane. Since the toe drain seam is at the toe of the slope in a location subject to lower

Date: 18 September 2007To: Mr. John ReggiFrom: Ralph Grismala

Subject: Geomembrane Seam Acceptance

Page: 4

tensile stresses in the geomembrane than most of the slope and since peel is not a foreseeable failure mode, we approved the trial seam tests¹.

The strength results for the GSE HD Textured HDT040G000 are consistent with the manufacturer's product specification which reports a tensile strength at break equal to 60 lb/in. Failure occurred in the weld in only 1 out of 16 tests.

All of the Upper Diversion Berm Field Seam tests met the specification criteria and are approved.

¹ The Toe Drain Field Seam was made on 8 Aug 2007. The laboratory tests were run on 27 Aug 2007. By then, the Toe Drain Field Seam had been covered by fill. The risks associated with a lower strength seam at the toe were assessed to be lower than the potential for damage to the liner by exposing the seam again for a small potential gain in seam strength.

Appendix D

Ormet Primary Aluminum Corporation CMSD Landfill Cap Repair

Design Modifications and Instrumentation Guidelines

- Toe Drain Revision, Design Detail, 9 August 2007
- Additional Perimeter Drain Pipe Outlet, 23 September 2007
- Displacement Monitors, 26 September 2007





9 Aug 2007

To: Mr. John Reggi, Ormet Primary Aluminum Corporation cc: Mr. John Mount, Kemron Environmental Services Mr. Stephen Poole, Kemron Environmental Services

Subject: Toe Drain Revision, Design Detail Ormet CMSD Landfill Cap Repair

Dear Mr. Reggi,

The attached drawing presents documentation of the revised design detail for the toe drain along the section undergoing repair on the south side of the Ormet CMSD landfill cap. The design revision was required due to differences between the original cap design and the actual field geometry. The toe of the geomembrane, defined as the point where the projection of the 4:1 slope of the geomembrane meets a horizontal surface at the elevation of the top of the riprap erosion protection (Elev. +630 ft. in the original design), is approximately 8 ft. closer to the river than called for in the design. In order to maintain a flat area at the toe of the slope sufficiently wide for vehicular access and to conform the geometry to match the slope profiles adjacent to the section under repair, we have increased the width of the slope toe drain and added vegetative support layer (VSL) soil above the drain.

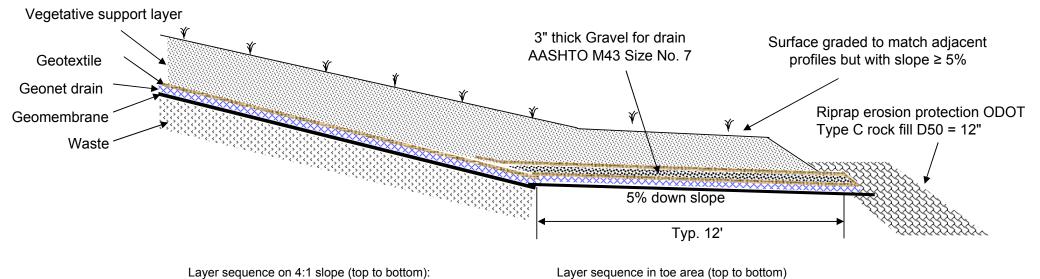
The attached drawing supersedes Inset 3 in Figure 2, Cross Sections, dated March 2007 of the specifications package. The change has been discussed with the Kemron field representative, Mr. Stephen Poole.

Since the current contract includes unit priced line items for geomembrane, geosynthetic drainage material, geotextile, and gravel for slope drains, this revised design detail does not require any contract modification, although it will alter the quantities of the above materials.

Best regards,

Ralph Grismala, P.E.

rismala



Gravel Gradation Requirements
AASHTO M43 Size No. 7

Geotextile

Geomembrane

Geonet

Sieve Size	Percent
in inches	Finer
1	100
3/4	100
1/2	90 to 100
3/8	40 to 70
No. 4	0 to 15
No. 8	0 to 5

Layer sequence in toe area (top to bottom)

Geotextile

Gravel

Geotextile

Geonet

Geomembrane

Notes:

The geotextile should be continuous, wrapping around the gravel.

This figure supersedes Inset 3 in Figure 2, Cross Sections, dated March 2007.

FIGURE 2, INSET 3 CROSS SECTIONS	
Prepared for: Ormet	Scale: As shown
Date: Aug 2007	Figure 2, Inset 3
ICF International	Sheet 1 of 1



21 Sep 2007

To: Mr. John Mount, Kemron Environmental Servicescc: Mr. John Reggi, Ormet Primary Aluminum CorporationMr. Michael Riley, Kemron Environmental Services

Subject: Additional Perimeter Drain Pipe Outlet Ormet CMSD Landfill Cap Repair

Dear Mr. Mount,

This letter documents a design modification for the Ormet CMSD Landfill Cap Repair involving an additional perimeter drain pipe outlet for the existing Perimeter Toe Drain.

The original CMSD landfill cap construction included a 4 inch diameter corrugated plastic perimeter drain pipe along the toe of the slope with several perpendicular outlet pipes. This revision specifies the installation of an additional outlet pipe at the east end of the perimeter drain pipe along the south slope of the CMSD landfill cap. The attached drawing (Figure 1) shows the approximate location of the additional outlet.

Purpose

The As Built drawings and construction report for the original CMSD landfill cap do not document the position or slope of the perimeter drain pipe. To reduce the possibility that water can accumulate within the perimeter drain pipe due to a downward slope to the east, an additional outlet pipe shall be installed near the east end of the perimeter drain pipe.

Description

The additional outlet pipe shall be installed in a manner similar to the outlet pipes installed in accordance with Section 31 00 00, Part 3.5.3 Transition at Edge of Reconstructed Section (originally numbered Part 3.4.3). The new specification below, Section 31 00 00, Part 3.5.4 describes the installation procedure.

3.5.4 Additional Perimeter Drain Outlet Pipe

The Contractor shall install an additional outlet pipe perpendicular to the perimeter drain pipe at the east end of the south side of the CMSD landfill cap, such that any effluent from the outlet pipe discharges beyond the toe of the slope.

The Contractor shall locate the existing perimeter pipe by excavating a trench perpendicular to the perimeter drain pipe in a location at the toe of the slope anticipated to intersect the perimeter drain pipe, taking care not to damage the existing perimeter drain pipe or geosynthetic materials. Any damage to the geomembrane shall be repaired at no cost to the Owner. The Contractor shall make the initial trial excavation approximately 30 feet west of the east end of the slope. If the perimeter drain pipe does not exist at that location, the Contractor shall make additional trial excavations each 20 feet west of the previous excavation until the perimeter drain pipe is located.

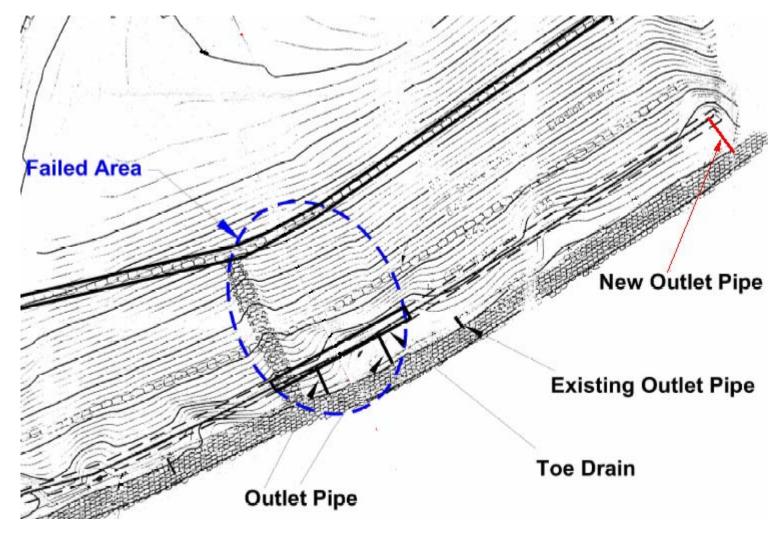
The additional outlet pipe shall be connected to the perimeter drain pipe with an elbow, if the excavation intersects the end of the existing perimeter drain pipe, or with a tee, if the trench intersects the existing perimeter drain pipe elsewhere.

The change has been discussed with the Kemron field representative, Mr. Kevin Shaver and the Kemron project manager, Mr. Michael Riley.

Since the current contract includes unit priced line items for Removal of Failed Slope Material, Vegetative Support Layer, and HDPE Pipe, this additional design detail does not require any contract modification, although it will alter the quantities of the above materials.

Best regards,

Ralph Grismala, P.E.



Plan View Toe Drain Additional Outlet Figure 1

Memorandum

Date: 26 September 2007

To: Steve Reichenbacher

ICF International

cc: John Reggi

Ormet Primary Aluminum Corporation

From: Ralph Grismala

ICF International rgrismala@icfi.com

Subject: Displacement Monitors, Ormet CMSD Landfill Cap

Re: 026156.0.003.00

This memorandum describes the installation and monitoring of the displacement monitors for the south side of the Ormet CMSD Landfill Cap.

Background

During the displacement of the CMSD Landfill Cap in June 2006, in addition to the large displacement that occurred in the middle of the south side of the cap, smaller displacements up to about two feet occurred primarily between the downchute and the east end of the slope.

Based on the analysis, it is probable that the large displacement was preceded by smaller displacements and the opening of cracks in the slope. The purpose of the displacement monitors is to establish a frame of reference for measuring any future displacements of the cap materials, to aid in the assessment of any observed cracks, and to facilitate timely maintenance of the cap.

Design

The displacement monitor system comprises three parallel rows of stakes, with the stakes in each row about 50 feet apart. One row should be located at the toe of the slope, one should be located near the top of the slope but below the location of the previous displacement (at least 30 feet measured along the slope below the crest), and one row should be located approximately halfway between those two rows. The first and last stakes in each row, which define the reference line, must be far enough from the anticipated zone of movement to be located in stable ground. We anticipate that each line of stakes will be approximately 400 feet long and therefore each line will contain nine stakes, but the final length and number of stakes will be determined in the field.

The design of the displacement monitors is described in more detail in Section 4.2.2 (excerpted below) of the report *Investigation of the CMSD Cap Failure and Specifications for Repair, Monitoring and Maintenance* dated 7 March 2007. For longevity, we recommend driving each monitoring stake with a layer of filter fabric at least two feet in diameter covered by at least two inches of gravel (rather than mulch) to act as a vegetation barrier and to facilitate mowing.

4.2.2 Displacement Monitors

In order to monitor early signs of any downslope movement of the CMSD cap materials, we recommend the placement of three lines of displacement monitors parallel to the slope crest at different heights upon the slope. Each displacement monitor can be a simple wooden stake, 18" to 24" long, driven 12 inches into the VSL. The stakes need to be clearly marked and protected from damage during mowing. Placing a layer of gravel or mulch around the base of the stakes may help limit vegetation growth. The stakes will be placed initially along three straight lines as determined by survey or laser alignment, with a spacing of 50 ft or less between stakes. The first and last stakes will be placed far enough from the repaired zone to be reasonably certain that they are not themselves within a zone of movement. The top of each stake will be permanently marked where the alignment line, defined by two points on the initial and final stakes, crosses the surface of the stake. During subsequent readings by reestablishing the alignment line between the points on the initial and final stakes, the deviation of the intermediate points from the alignment line, if any, will be recorded.

Figure 1, below, shows the approximate locations for the displacement monitors and the proposed numbering system. Each monitoring stake must be clearly marked in the field.

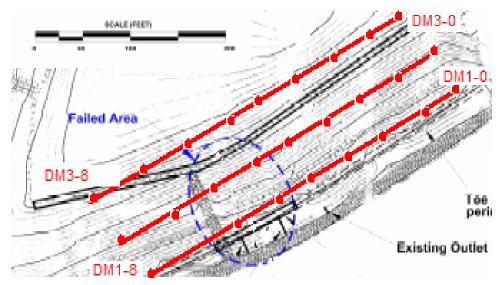


Figure 1: Displacement Monitor Locations and Proposed Numbering System

Data Collection

The horizontal distance between the marked point on the top of each stake and the reference line will be measured upon installation. Subsequent readings involve remeasuring these horizontal distances from the reference lines and tracking any changes over time. We propose that readings be taken every three months for the first year and semiannually thereafter.

Appendix E

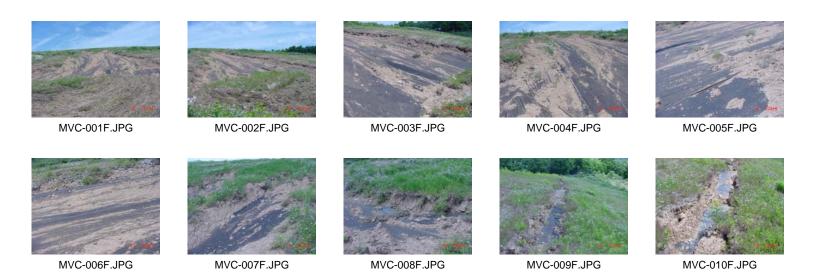
Ormet Primary Aluminum Corporation

CMSD Landfill Cap Repair

Construction Photographs

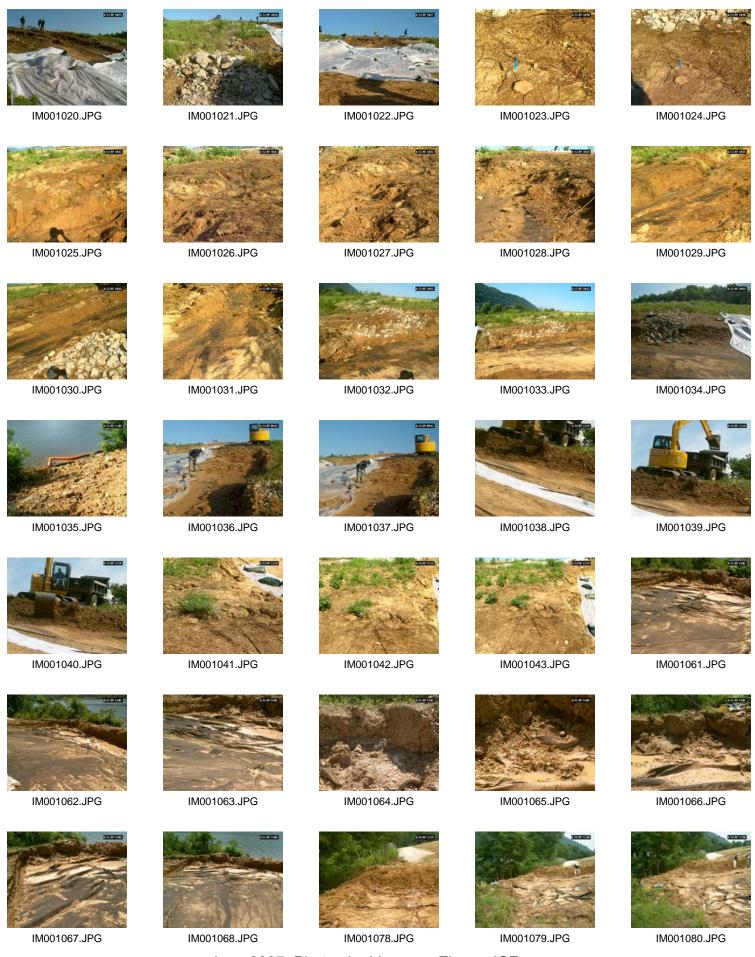
- June 2006, Photos by Ormet
- 19 June 2006, Photos by Ralph Grismala, ICF
- 7 December 2006, Photos by Ralph Grismala, ICF
- June 2007, Photos by Lianyang Zhang, ICF
- July 2007, Photos by Lianyang Zhang, ICF
- 12 July 2007, Photos by Ralph Grismala, ICF
- 24-25 July 2007, Photos by Steve Reichenbacher, ICF
- August 2007, Photos by Steve Reichenbacher, ICF
- 14-22 August 2007, Photos by Steve Reichenbacher, ICF
- 29 August 2007, Photos by Ralph Grismala, ICF
- September 2007, Photos by Steve Reichenbacher, ICF
- 11-12 September 2007, Photos by Steve Reichenbacher, ICF
- 19-20 September 2007, Photos by Steve Reichenbacher, ICF
- 26 September 2007, Photos by Steve Reichenbacher, ICF
- 27-28 September 2007, Photos by Steve Reichenbacher, ICF



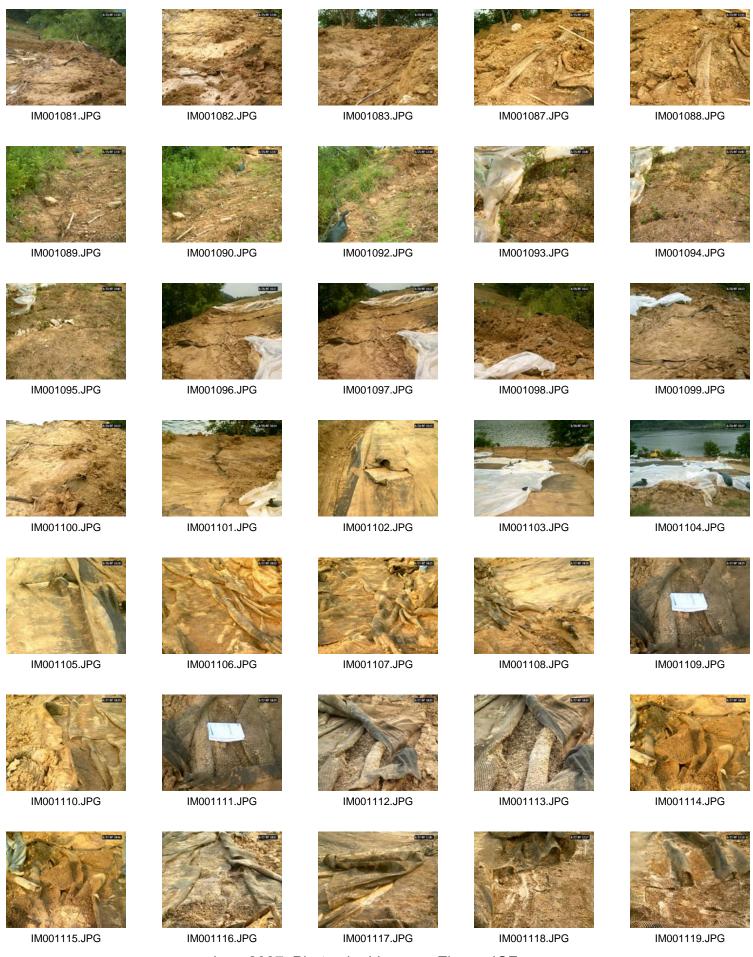








June 2007, Photos by Lianyang Zhang, ICF



June 2007, Photos by Lianyang Zhang, ICF



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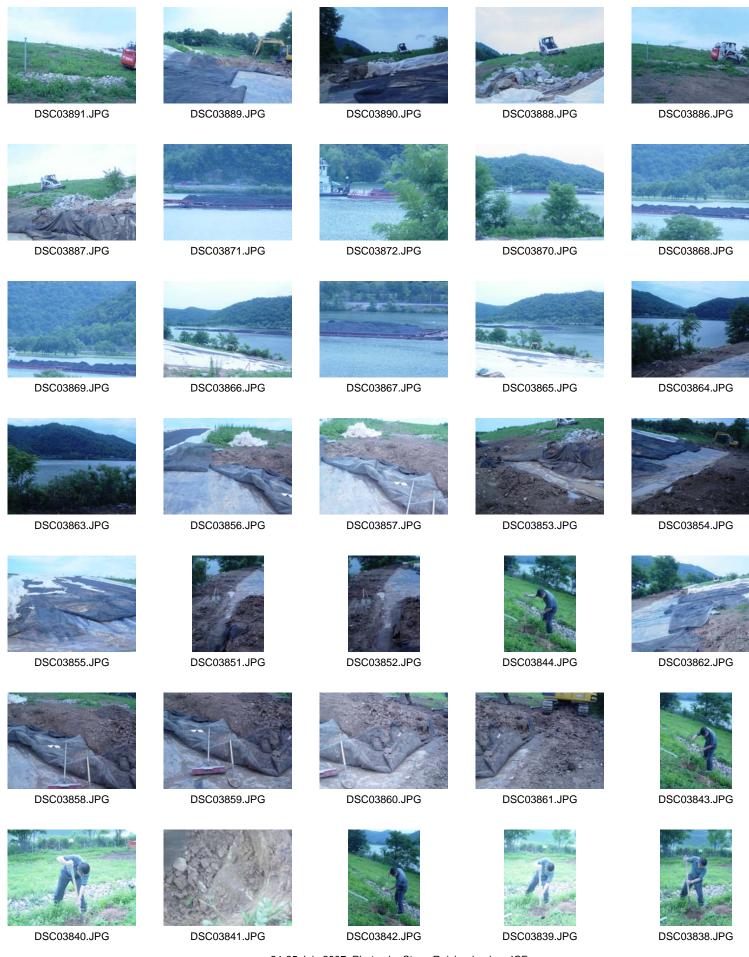






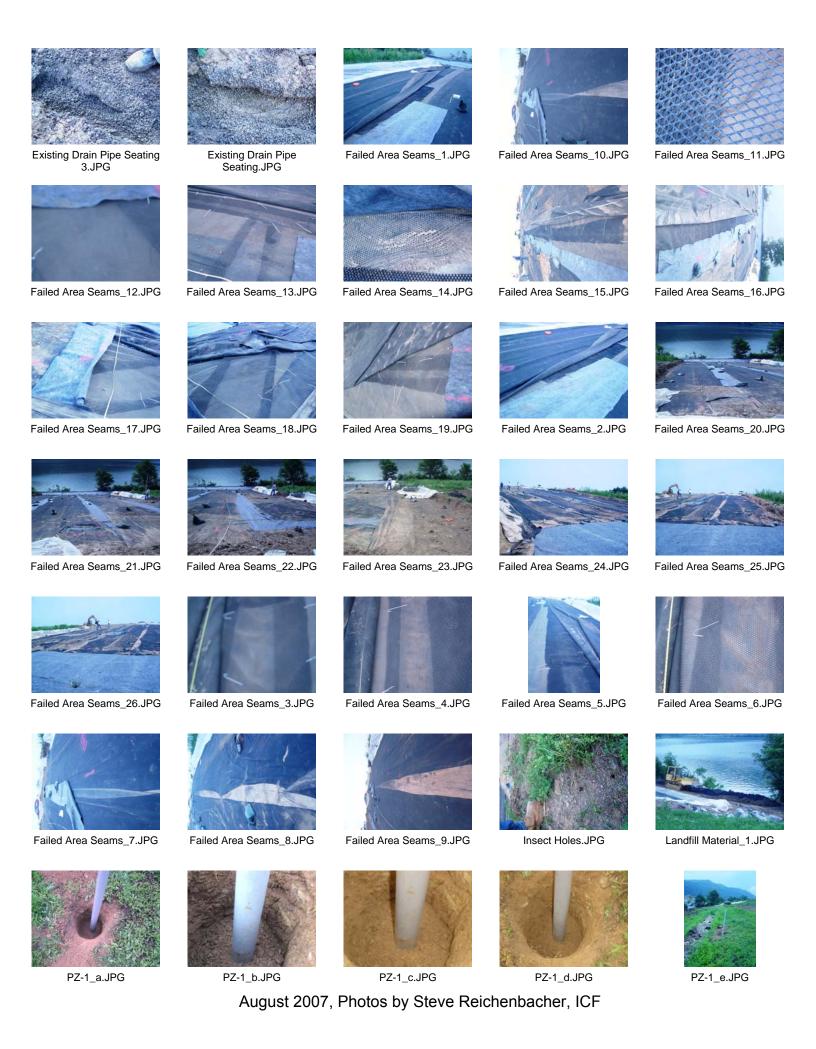
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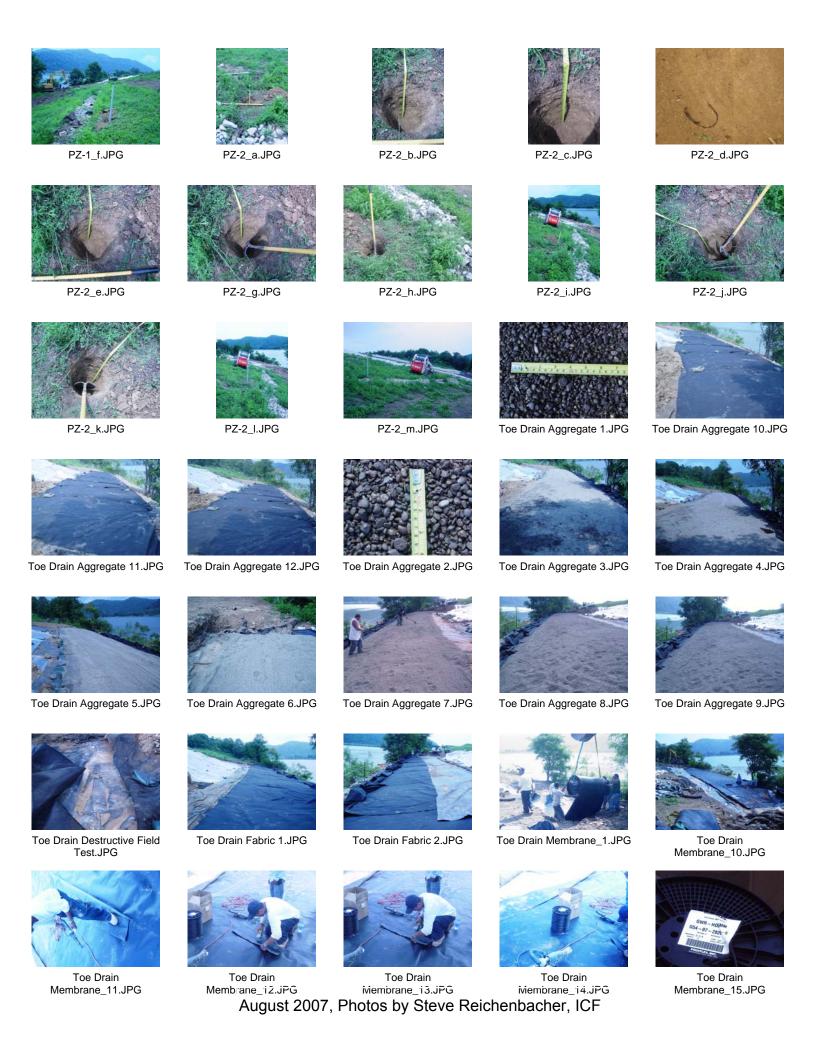
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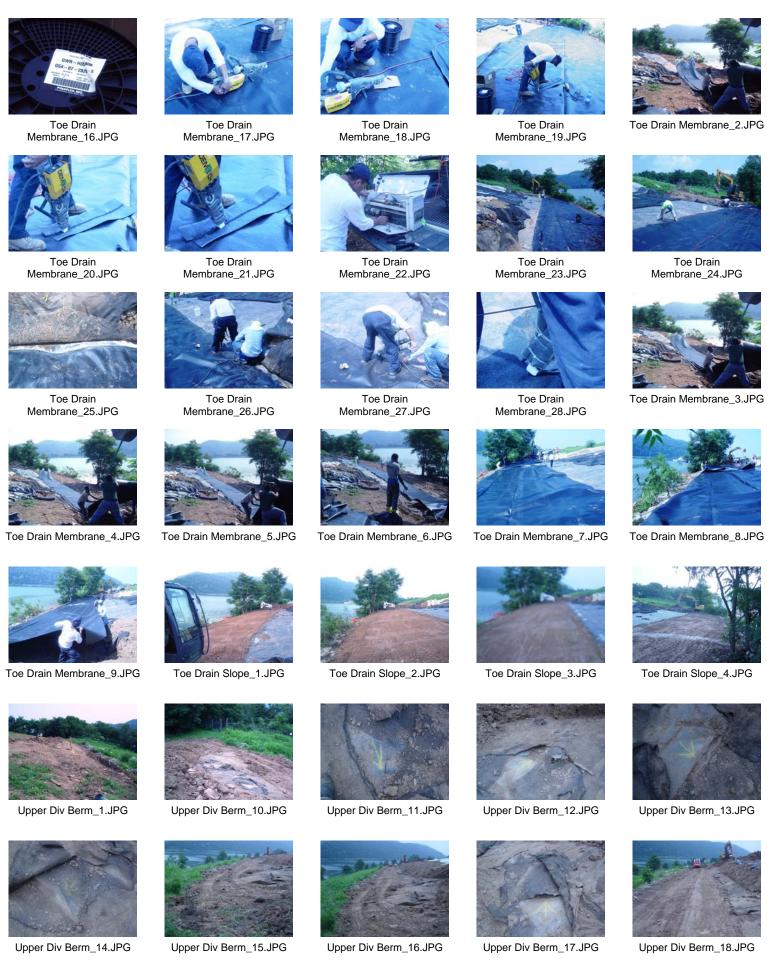


24-25 July 2007, Photos by Steve Reichenbacher, ICF









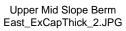
August 2007, Photos by Steve Reichenbacher, ICF



Upper Div Berm_8.JPG



Upper Div Berm_6.JPG

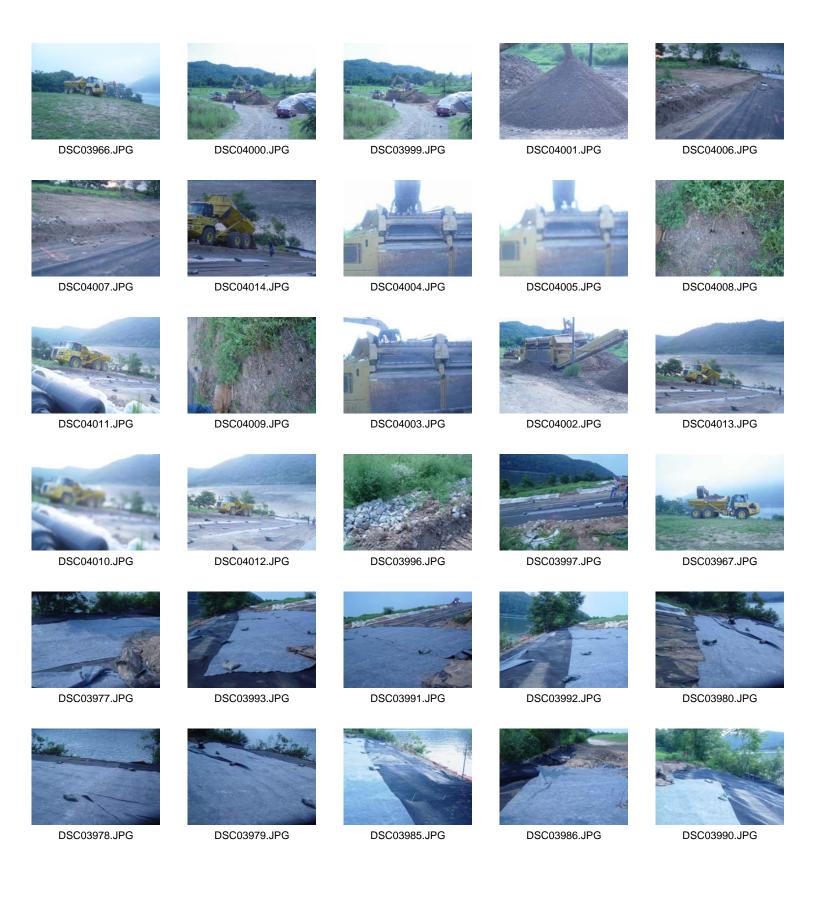


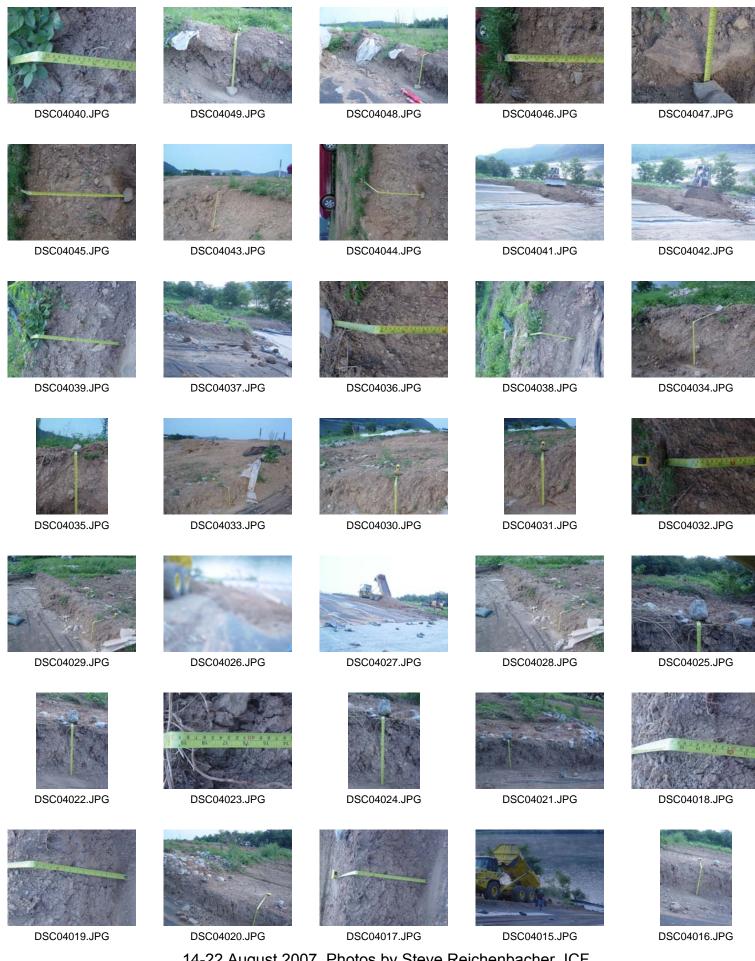


Upper Div Berm_7.JPG

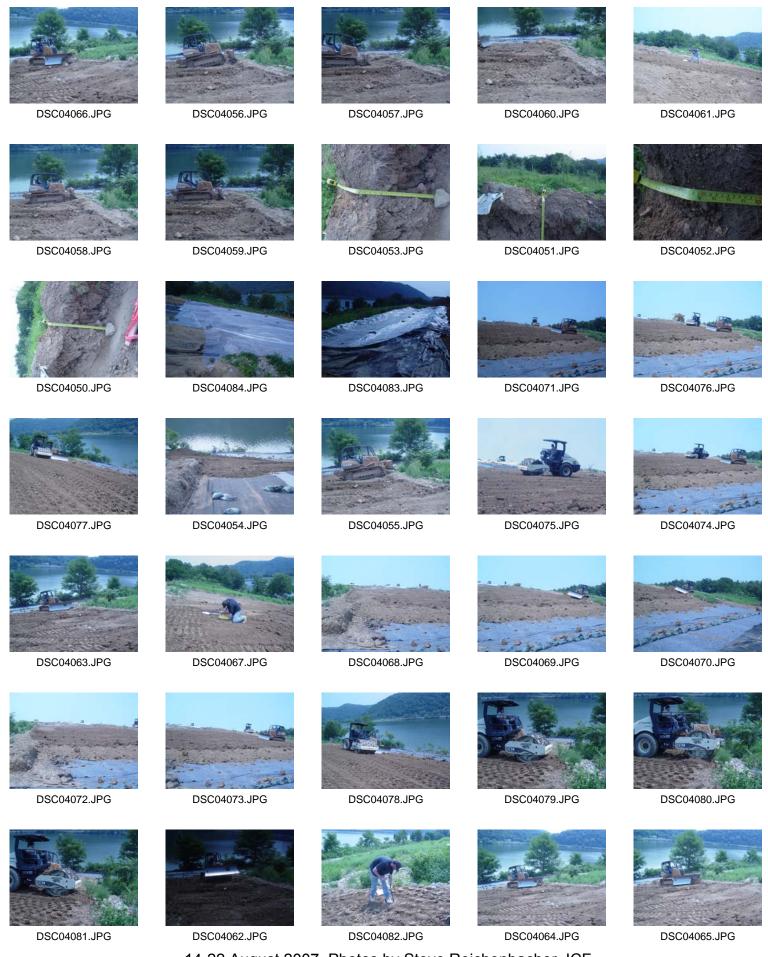
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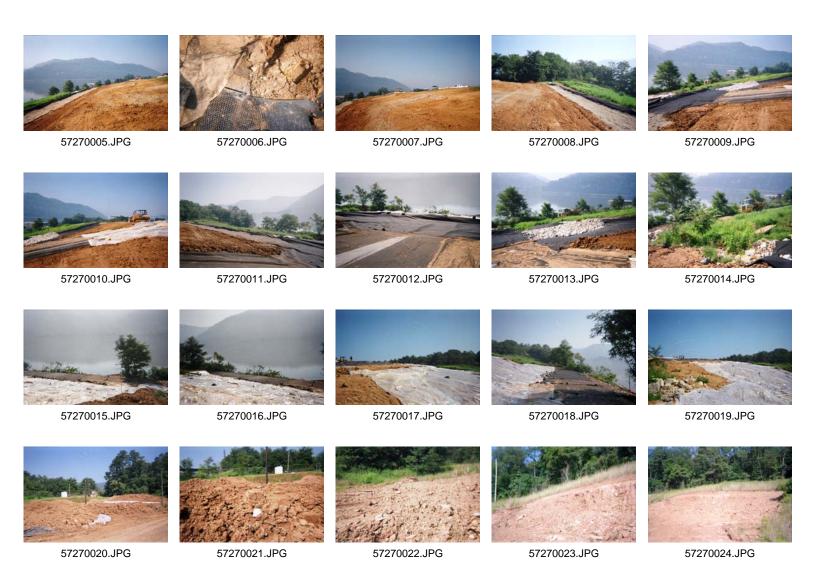
14-22 August 2007, Photos by Steve Reichenbacher, ICF

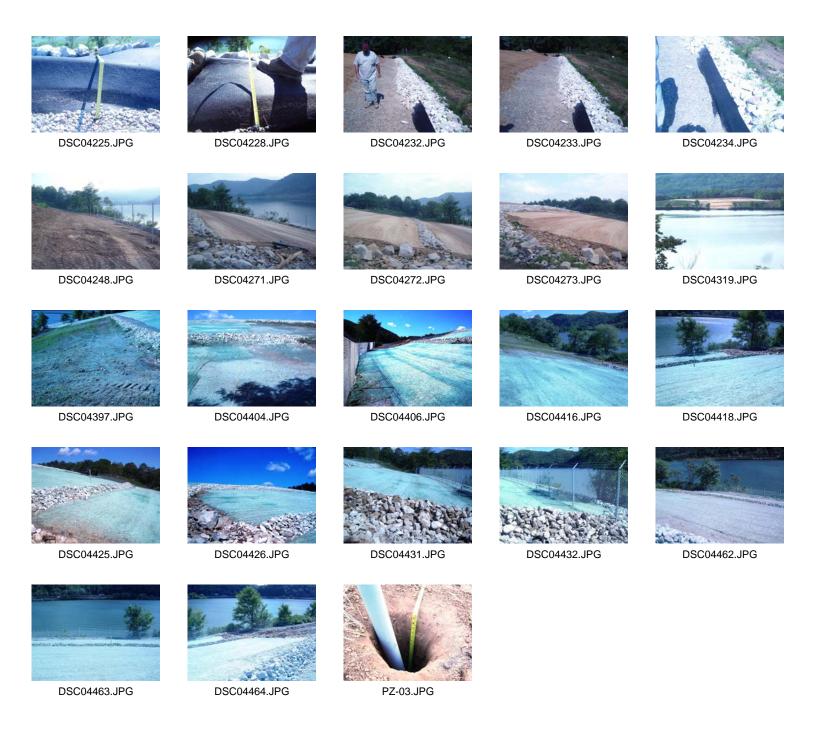


14-22 August 2007, Photos by Steve Reichenbacher, ICF

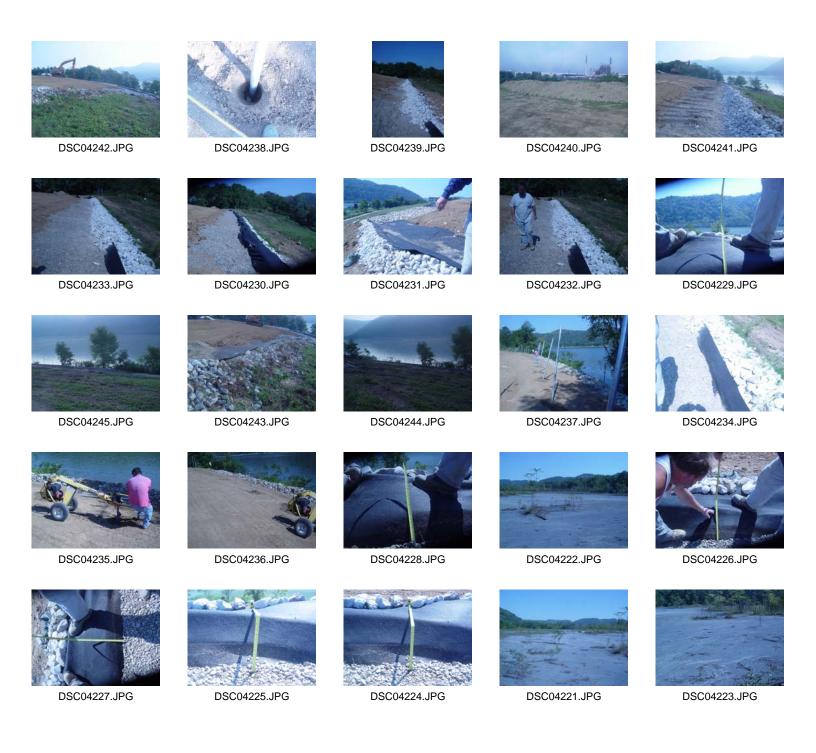


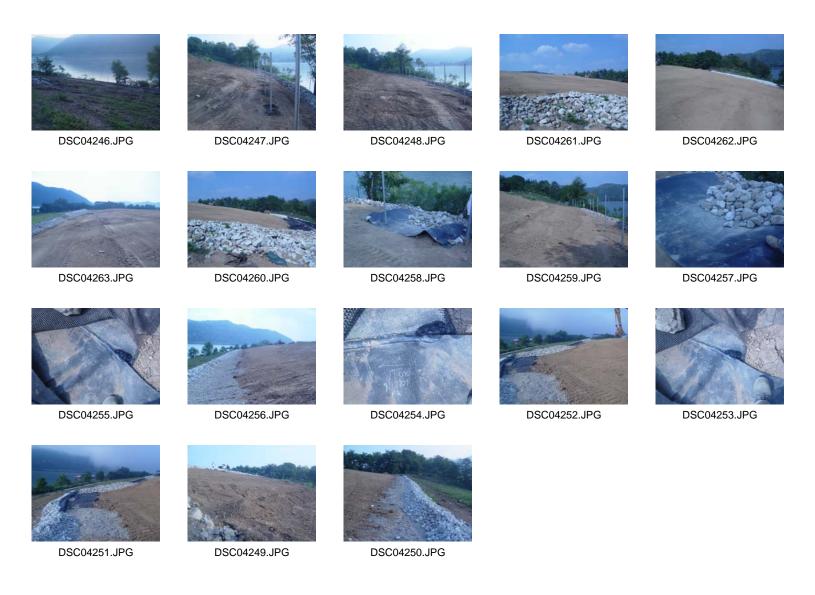
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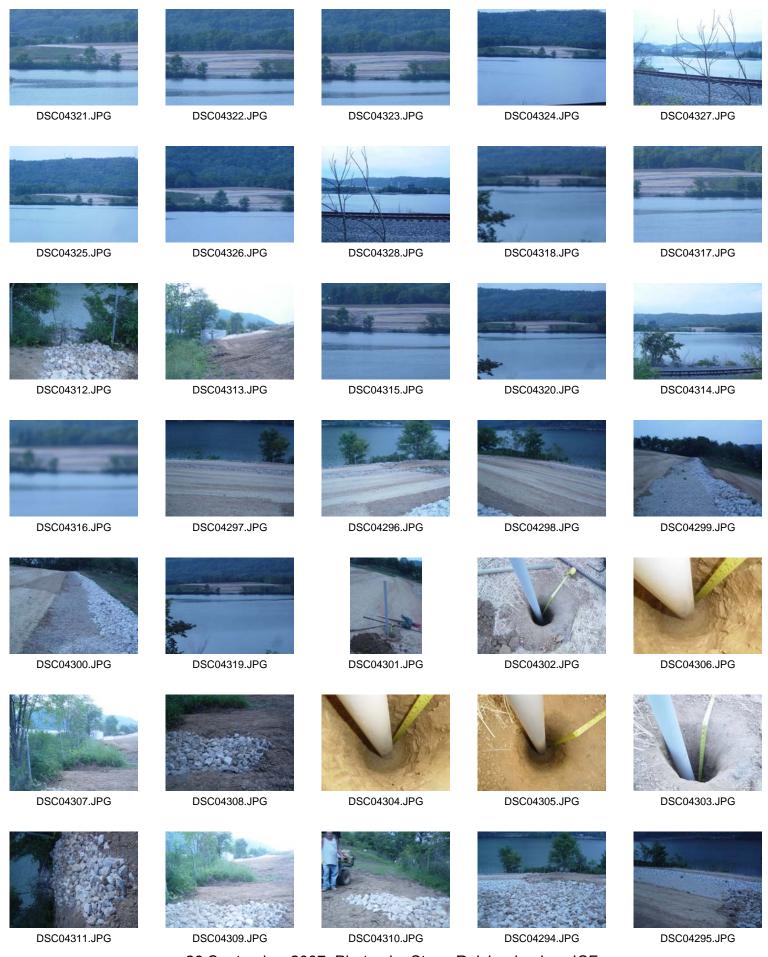




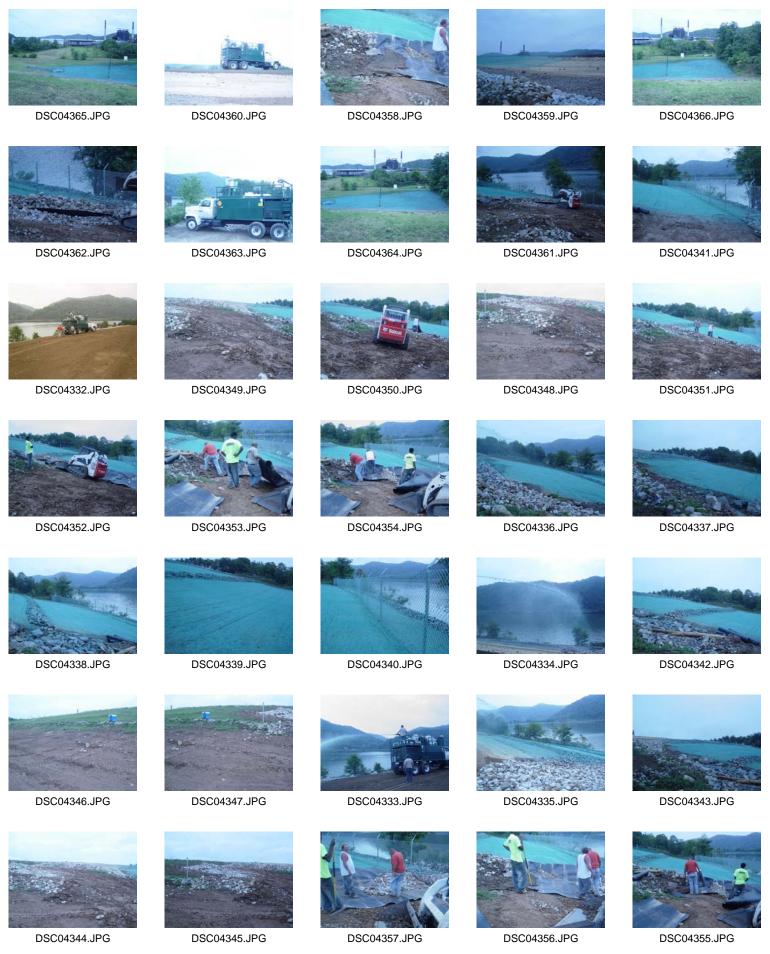




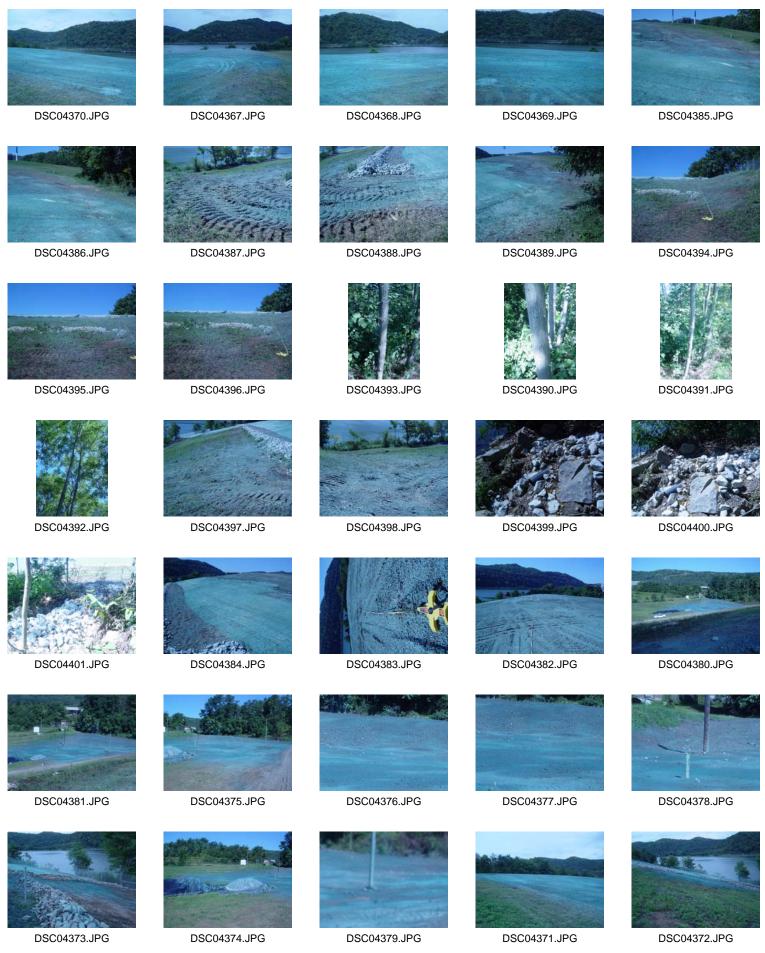




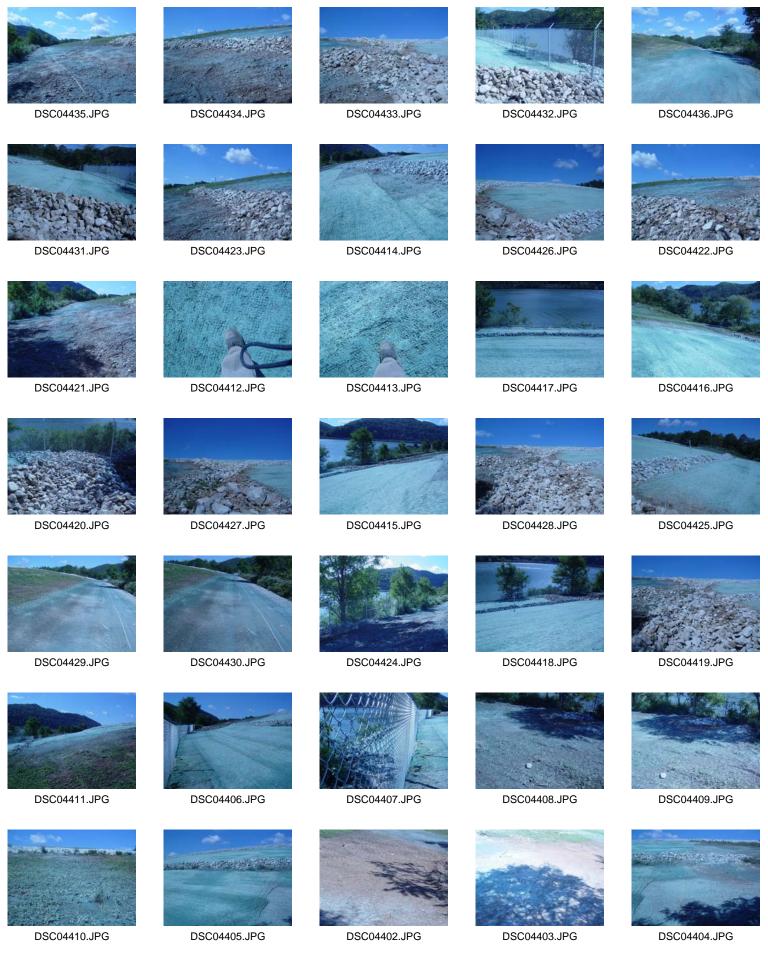
26 September 2007, Photos by Steve Reichenbacher, ICF



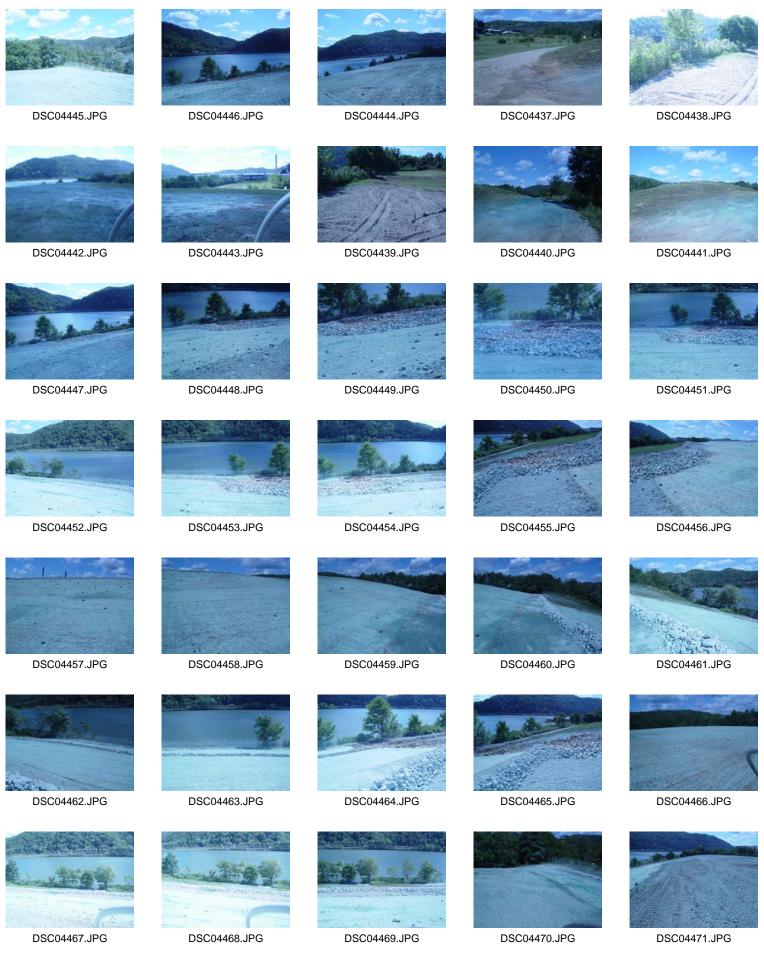
27-28 September 2007, Photos by Steve Reichenbacher, ICF



27-28 September 2007, Photos by Steve Reichenbacher, ICF



27-28 September 2007, Photos by Steve Reichenbacher, ICF



27-28 September 2007, Photos by Steve Reichenbacher, ICF